YAMAHA

Outboards

T9.9W
F9.9W

SERVICE MANUAL

LIT-18616-01-83

A20000-1

NOTICE

This manual has been prepared by the Yamaha Motor Company, Ltd. primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because the Yamaha Motor Company, Ltd. has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

A10001-0*

T9.9W, F9.9W
SERVICE MANUAL
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HOW TO USE THIS MANUAL

MANUAL FORMAT

All of the procedures in this manual are organized in a sequential, step-by-step format. The information has been compiled to provide the mechanic with an easy to read, handy reference that contains comprehensive explanations of all disassembly, repair, assembly, and inspection operations.
In this revised format, the condition of a faulty component will precede an arrow symbol and the course of action required will follow the symbol, e.g.,

- Bearing
  Pitting/Damage → Replace.

To assist you to find your way about this manual, the Section Title and Major Heading is given at the head of every page.

An Index to contents is provided on the first page of each section.

THE ILLUSTRATIONS

Some illustrations in this manual may differ from the model you have. This is because a procedure described may relate to several models, though only one may be illustrated. (The name of the model described will be mentioned in the description).

REFERENCES

Reference have been kept to a minimum; however, when you are referred to another section of the manual, you are told the page number to go to.

SPECIFICATIONS

These are given in bold type at each procedure. It is not necessary to have the section dealing with the procedure in order to look up the specifications.
It is important to note the differences in specifications of models. Where a procedure relates to more than one model, the main differences in specifications will be shown in the following table.

Item \ Model	F8BMH	F8BEH	F8BE	T9,9MH/ FT9.9AMH	T9.9EH/FT9.9AEH
Starting system	Manual start	Electric start	Electric start	Manual start	Electric start
Control system	Manual control	Manual control	Remote control	Manual control	Manual control
Tilt system	Manual tilt	Manual tilt	Manual tilt	Manual tilt	Manual tilt
Carburetor (Pilot screw)	Adjustable screw*1	Adjustable screw*1	Adjustable screw*1	Adjustable screw*1	Adjustable screw*1
	None adjustable screw*2	None adjustable screw*2	None adjustable screw*2	None adjustable screw*2	None adjustable screw*2

Item \ Model	T9.9ER/FT9.9AE	F9.9MH/F9.9BMH	F9.9EH/F9.9BEH	F9.9BE
Starting system	Electric start	Manual start	Electric start	Electric start
Control system	Remote control	Manual control	Manual control	Remote control
Tilt system	Manual tilt	Manual tilt	Manual tilt	Manual tilt
Carburetor (Pilot screw)	Adjustable screw*1	Adjustable screw*1	Adjustable screw*1	Adjustable screw*1
	None adjustable screw*2	None adjustable screw*2	None adjustable screw*2	None adjustable screw*2

*1: Except for USA and Switzerland
*2: For USA and Switzerland

WARNINGS, CAUTIONS AND NOTES

Attention is drawn to the various Warnings, Cautions and Notes with distinguished important information in this manual in the following ways.

⚠ The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING

Failure to follow WARNING instructions could result in severe injury or death to the machine operator, a bystander, or a person inspecting or repairing the outboard motor.

CAUTION:

A CAUTION indicates special precautions that must be taken to avoid damage to the outboard motor.

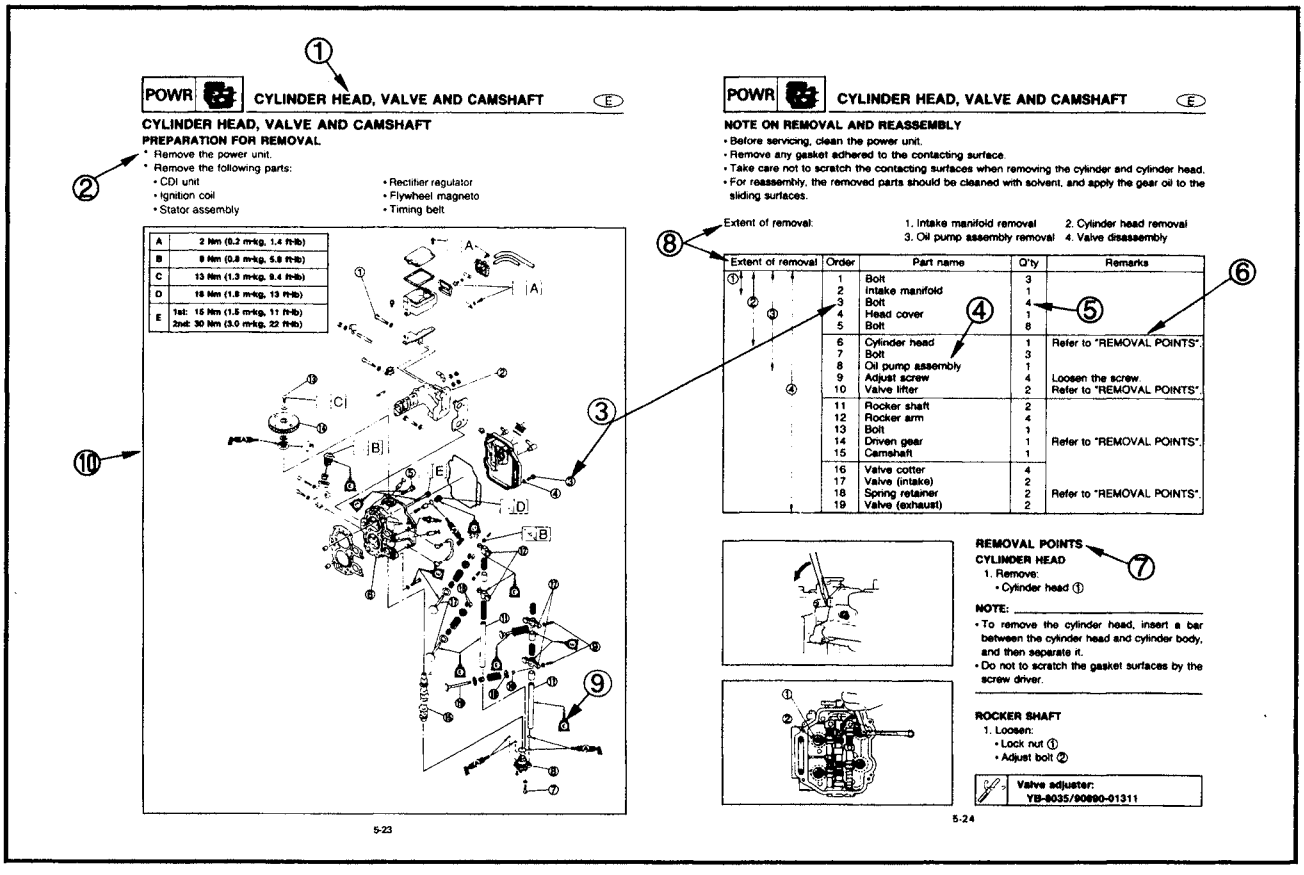
NOTE:

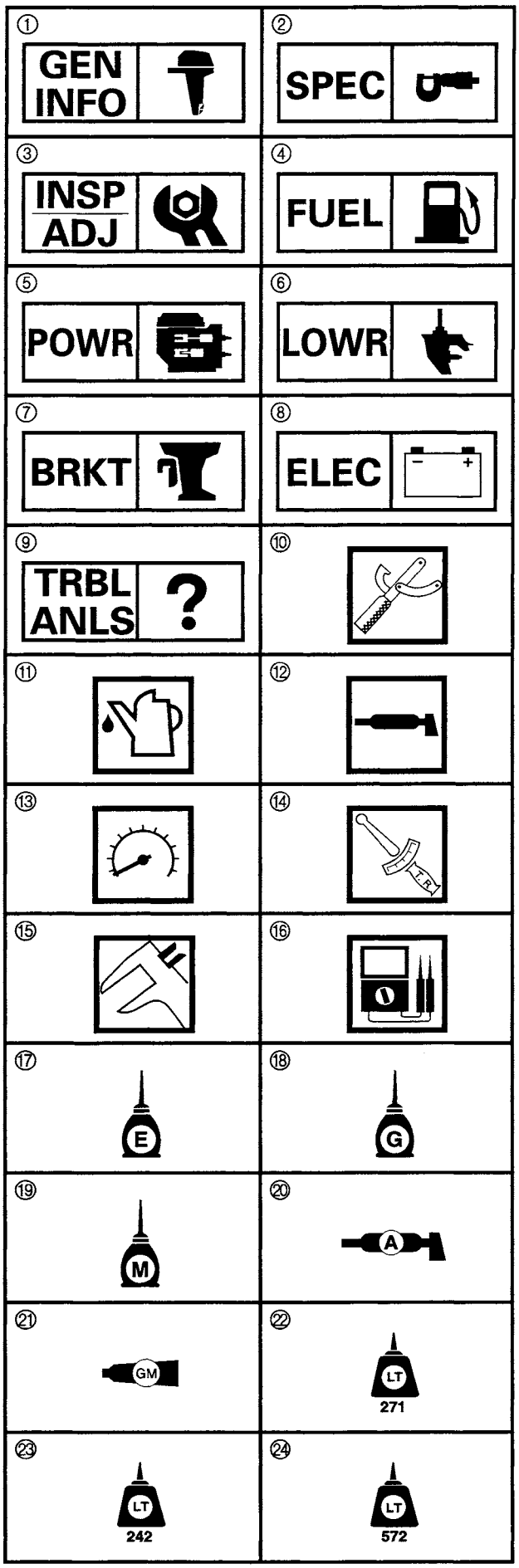
A NOTE provides key information to make procedures easier or clearer.

HOW TO READ DESCRIPTIONS

1. An easy-to-see disassembly illustration is mainly provided for a disassembly job.
2. Numbers are given in the order of a disassembly job in the disassembly illustration.
3. An explanation of jobs and notes is presented in an easy-to-read way by the use of symbol marks. The meanings of the symbol marks are given on the next page.
4. A job instruction chart accompanies the assembly illustration, providing the order of jobs, names of parts, notes in jobs, etc.
5. In addition to the disassembly illustration, "REMOVAL POINTS" is provided to supplement in detail the explanation which does or cannot necessarily cover the main jobs.
6. Jobs necessary before and after those which are not included in the disassembly illustration are explained before the same illustration as related jobs.

① Section
② Preparation for removal
③ Order of removal
④ Part name
⑤ Q'ty
⑥ Remarks
⑦ Removal points
⑧ Extent of removal
⑨ Symbol mark
⑩ Exploded diagram


①
②
③
④
⑤
⑥
⑦
⑧
⑨
⑩
POWR
CYLINDER HEAD, VALVE AND CAMSHAFT
E
CYLINDER HEAD, VALVE AND CAMSHAFT
PREPARATION FOR REMOVAL
* Remove the power unit.
* Remove the following parts:
• CDI unit
• Ignition coil
• Stator assembly
• Rectifier regulator
• Flywheel magneto
• Timing belt
A 2 Nm (0.2 m•kg, 1.4 ft•lb)
B 9 Nm (0.9 m•kg, 6.5 ft•lb)
C 13 Nm (1.3 m•kg, 9.4 ft•lb)
D 18 Nm (1.8 m•kg, 13 ft•lb)
E 1st: 15 Nm (1.5 m•kg, 11 ft•lb)
2nd: 30 Nm (3.0 m•kg, 22 ft•lb)
A
B
C
D
E
5-23
POWR
CYLINDER HEAD, VALVE AND CAMSHAFT
E
NOTE ON REMOVAL AND REASSEMBLY
• Before servicing, clean the power unit.
• Remove any gasket adhered to the contacting surface.
• Take care not to scratch the contacting surfaces when removing the cylinder and cylinder head.
• For reassembly, the removed parts should be cleaned with solvent, and apply the gear oil to the sliding surfaces.
Extent of removal:
1. Intake manifold removal
2. Cylinder head removal
3. Oil pump assembly removal
4. Valve disassembly
Extent of removal | Order | Part name | Q'ty | Remarks
1 | Bolt | 3
2 | Intake manifold | 1
3 | Bolt | 4
4 | Head cover | 1
5 | Bolt | 8
6 | Cylinder head | 1 | Refer to "REMOVAL POINTS".
7 | Bolt | 3
8 | Oil pump assembly | 1
9 | Adjust screw | 4 | Loosen the screw.
10 | Valve lifter | 2 | Refer to "REMOVAL POINTS".
11 | Rocker shaft | 2
12 | Rocker arm | 4
13 | Bolt | 1
14 | Driven gear | 1 | Refer to "REMOVAL POINTS".
15 | Camshaft | 1
16 | Valve cotter | 4
17 | Valve (intake) | 2
18 | Spring retainer | 2 | Refer to "REMOVAL POINTS".
19 | Valve (exhaust) | 2
REMOVAL POINTS
CYLINDER HEAD
1. Remove:
• Cylinder head ①
NOTE:
• To remove the cylinder head, insert a bar between the cylinder head and cylinder body, and then separate it.
• Do not to scratch the gasket surfaces by the screw driver.
ROCKER SHAFT
1. Loosen:
• Lock nut ①
• Adjust bolt ②
Valve adjuster: YB-9035/90890-01311
5-24



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SYMBOLS

Symbols ① to ⑨ are designed as thumb-tabs to indicate the content of a chapter.

① General Information
② Specifications
③ Periodic Inspection and Adjustment
④ Fuel System
⑤ Power Unit
⑥ Lower Unit
⑦ Bracket Unit
⑧ Electrical System
⑨ Trouble analysis

Symbols ⑩ to ⑯ indicate specific data:

⑩ Special Tool
⑪ Specified liquid
⑫ Specified grease
⑬ Specified engine speed
⑭ Specified torque
⑮ Specified measurement
⑯ Specified electrical value [Resistance (Ω), Voltage (V), Electric current (A)]

Symbol ⑰ to ⑳ in an exploded diagram indicate grade of lubricant and location of lubrication point:

⑰ Apply Yamaha engine oil
⑱ Apply Yamaha gear-case lubricant
⑲ Apply molybdenum disulfide oil
⑳ Apply water resistant grease (Yamaha marine grease A, Yamaha marine grease)

Symbols ㉑ to ㉔ in an exploded diagram indicate grade of sealing or locking agent, and location of application point:

㉑ Apply Gasket Maker®
㉒ Apply LOCTITE® No. 271 (Red LOCTITE)
㉓ Apply LOCTITE® No. 242 (Blue LOCTITE)
㉔ Apply LOCTITE® No. 572

NOTE:

In this manual, the above symbols may not be used in every case.

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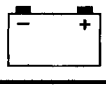
BRACKET UNIT	BRKT	7
ELECTRICAL SYSTEM	 ELEC	8
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CHAPTER 1
GENERAL INFORMATION

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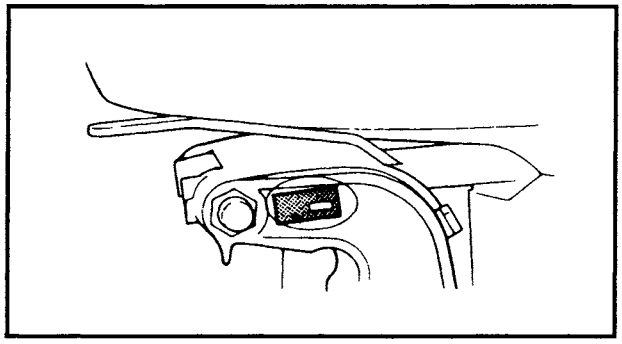

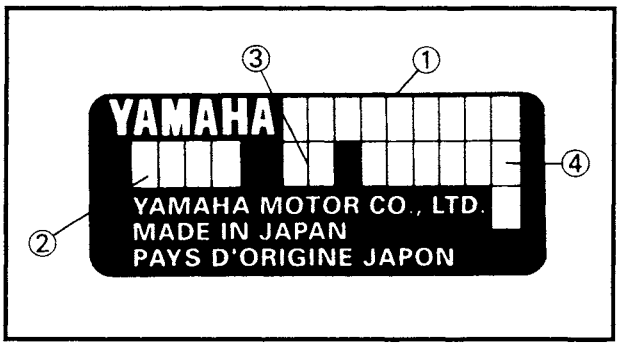

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IDENTIFICATION

SERIAL NUMBER

The serial number of the outboard motor is stamped on a plate attached to the port side of the clamp bracket.

NOTE:

For USA model:
As an anti-theft measure, a special label on which the outboard motor serial number is stamped is bonded to the portside of the clamp bracket. The label is specially treated so that peeling it off causes cranks across the serial number

① Model name
② Approved model No.
③ Transom height
④ Serial number

STARTING SERIAL NUMBERS

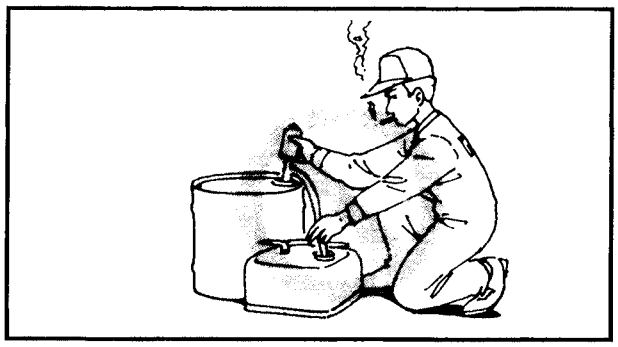
The starting serial number blocks are as follows:

Model		Approved model No.	Serial Number
Worldwide	USA, CANADA		
F8BMH	—	6J7	S: 000490 ~
			L: 301713 ~
F8BEH	—		S: 200158 ~
			L: 500786 ~
F8BE	—		S: 100302 ~
			L: 400964 ~

Model		Approved model No.	Serial Number
Worldwide	USA, CANADA		
FT9.9AMH	T9.9MH	6G8	L: 304623 ~
			X: 703474 ~
FT9.9AEH	T9.9EH		L: 472276 ~
			X: 788442 ~
FT9.9AE	T9.9ER		S: 101224 ~
			L: 413584 ~
			X: 762552 ~
F9.9BMH	F9.9MH	6G9	S: 010452 ~
			L: 308168 ~
F9.9BEH	F9.9EH		S: 200421 ~
			L: 500514 ~
F9.9BE	—		S: 101488 ~
			L: 402044 ~

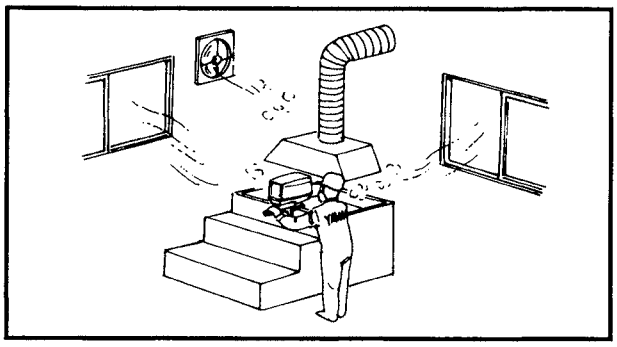
SAFETY WHILE WORKING

The procedures given in this manual are those recommended by Yamaha to be followed by Yamaha dealers and their mechanics.



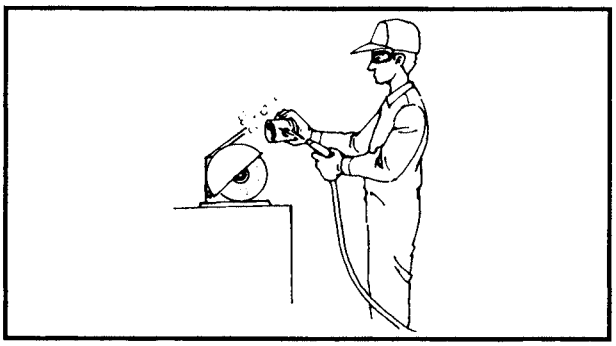
FIRE PREVENTION

Gasoline (petrol) is highly flammable.
Petroleum vapor is explosive if ignited.
Do not smoke while handling gasoline (petrol), and keep it away from heat, sparks, and open flames.



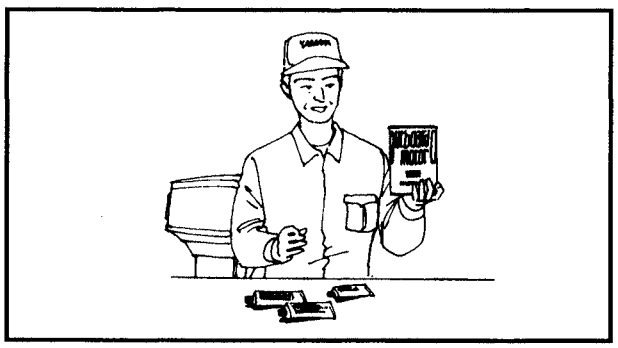
VENTILATION

Petroleum vapor is heavier than air and if inhaled in large quantities will not support life. Engine exhaust gases are harmful to breathe. When test-running an engine indoors, maintain good ventilation.



SELF-PROTECTION

Protect your eyes with suitable safety spectacles or safety goggles when using compressed air, when grinding or when doing any operation which may cause particles to fly off.
Protect hands and feet by wearing safety gloves or protective shoes appropriate to the work you are doing.

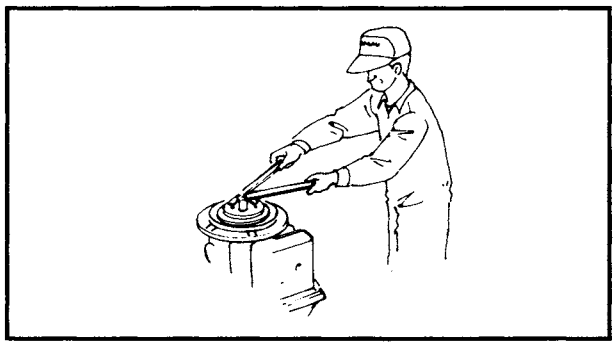


OILS, GREASES AND SEALING FLUIDS

Use only genuine Yamaha oils, grease and sealing fluids or those recommended by Yamaha.

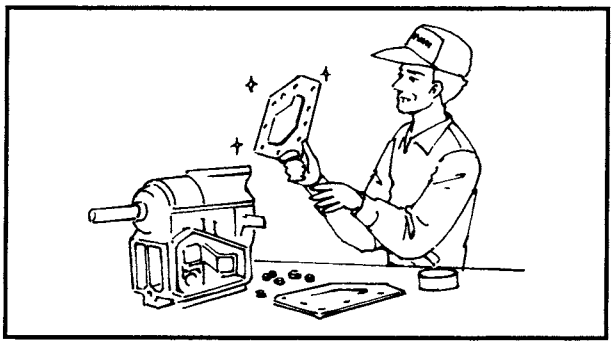
Under normal conditions of use, there should be no hazards from the use of the lubricants mentioned in this manual. However safety is all-important, and by adopting good safety practices, any risk is minimized.
A summary of the most important precautions is as follows:

1. While working, maintain good standards of personal and industrial hygiene.
2. Clothing which has become contaminated with lubricants should be changed as soon as practicable and laundered before further use.
3. Avoid skin contact with lubricants; do not, for example, place a soiled wiping-rag in one's pocket.
4. Hands, and any other part of the body which have been in contact with lubricants or lubricant-contaminated clothing, should be thoroughly washed with hot water and soap as soon as practicable.
5. To protect the skin, the application of a suitable barrier cream to the hands before working is recommended.
6. A supply of clean, lint-free cloths should be available for wiping purposes.

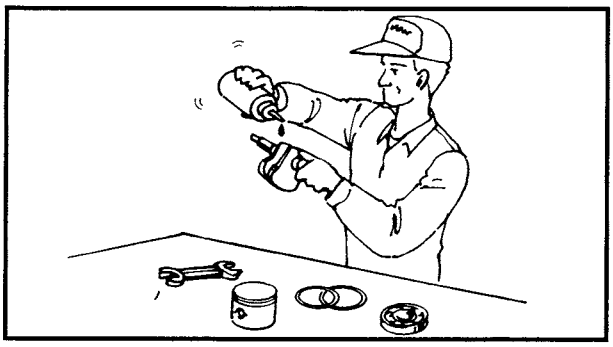


GOOD WORKING PRACTICES

1. **The right tools**
   Use the special tools that are advised to protect parts from damage. Use the right tool in the right manner – don't improvise.
2. **Tightening torque**
   Follow the torque tightening instructions. When tightening bolts, nuts and screws, tighten the large sizes first, and tighten inner-positioned fixings before outer positioned ones.

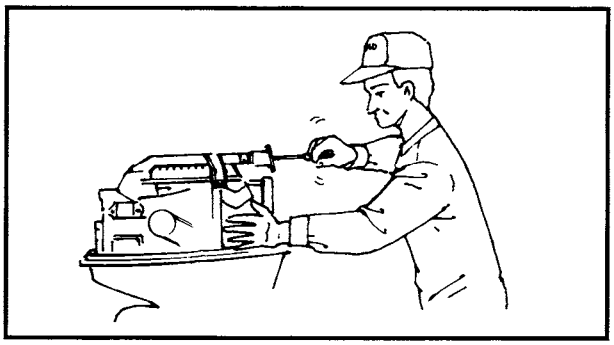


3. **Non-reusable items**
   When reassembling, always use new gaskets, packings, O-rings, oil seals, split-pins and circlips, etc.



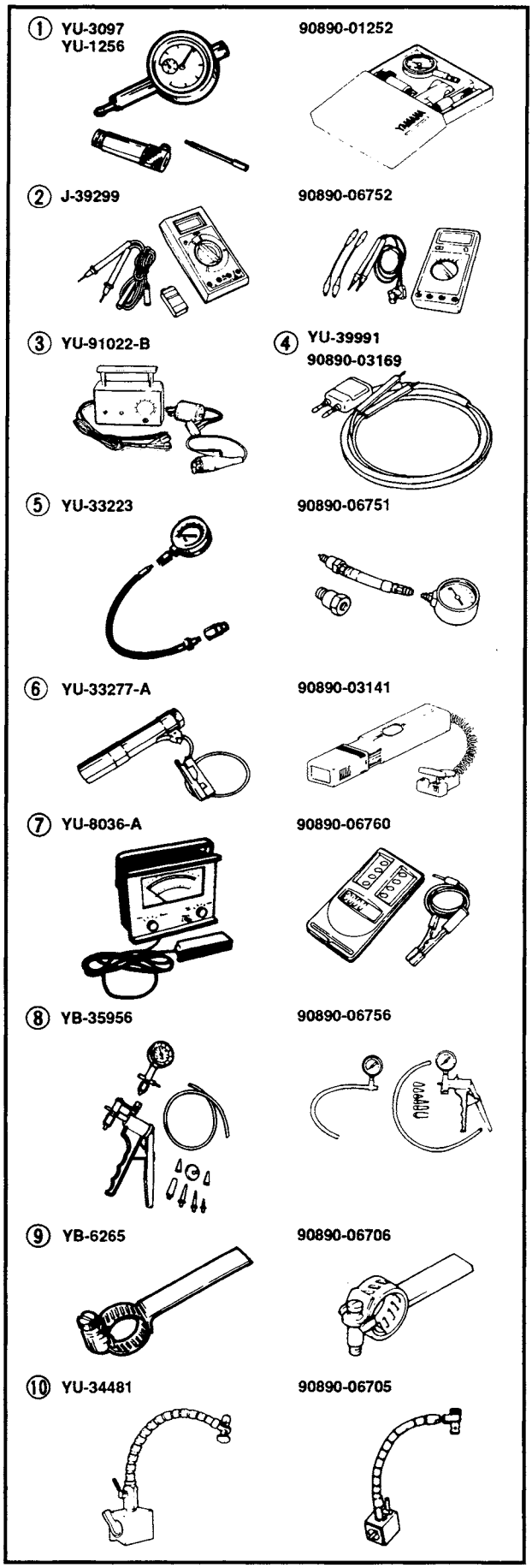
DISASSEMBLY AND ASSEMBLY

1. Clean parts with compressed-air when disassembling them.
2. Oil the contact surfaces of moving parts before assembly.



3. After assembly, check that moving parts operate normally.

4. Install bearing with the manufacturer's markings on the side exposed to view and liberally oil the bearings.
5. When installing oil seals, apply a light coating of water-resistant grease to the outside diameter.



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SPECIAL TOOLS

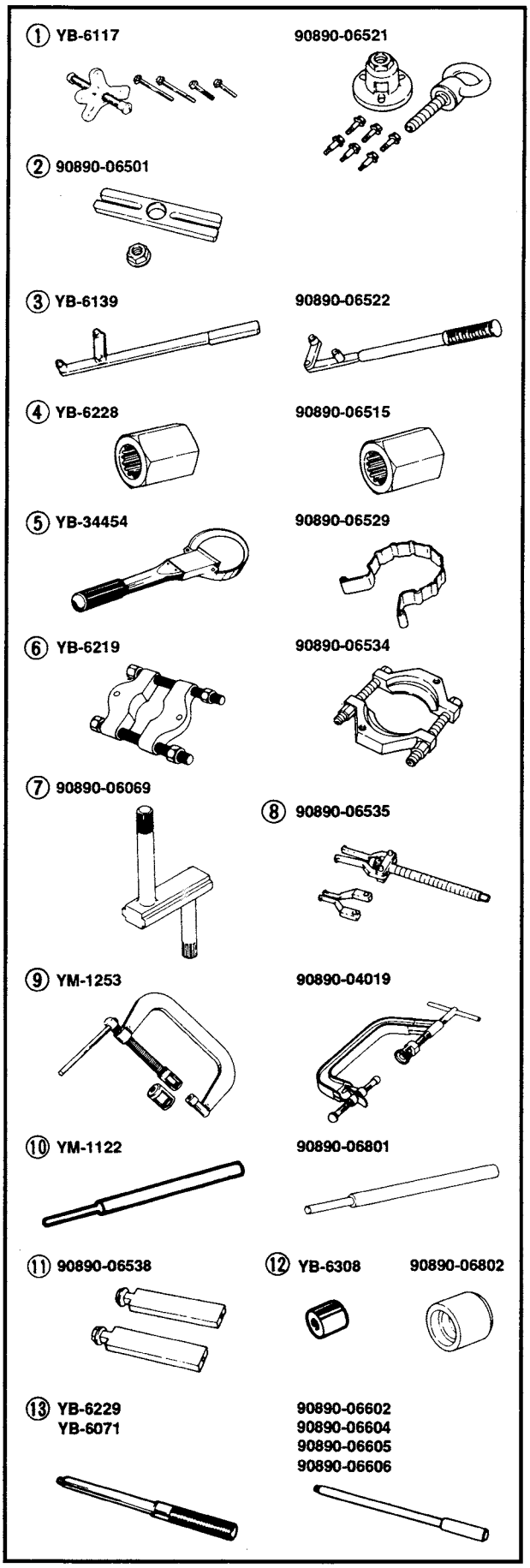
The use of correct special tools recommended by Yamaha will aid the work and enable accurate assembly and tune-up. Improvisations and use of improper tools can cause damage to the equipment.

NOTE:

- For USA and Canada, use part numbers starting with "J-", "YB-", "YM-", "YU-" or "YW-".
- For others, use part numbers starting with "90890-".

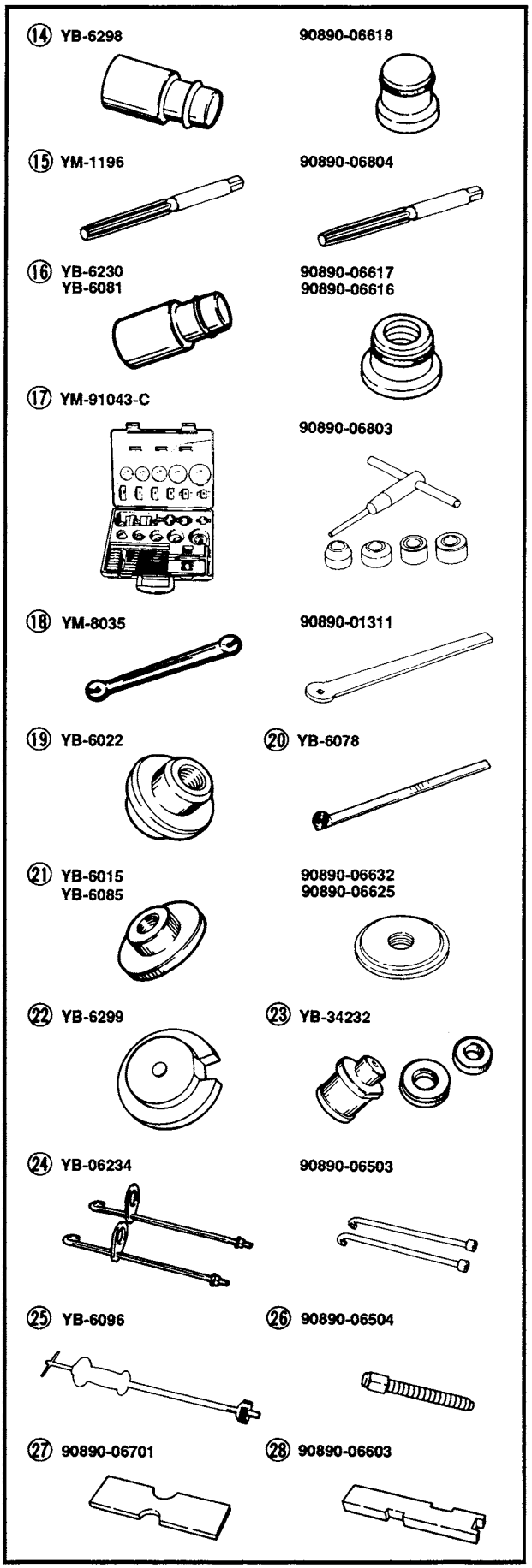
MEASURING

1. Dial gauge and stand
   P/N. YU-3097, YU-1256
   90890-01252
2. Digital multi meter
   P/N. J-39299
   90890-06752
3. CDI tester
   P/N. YU-91022-B
4. Peak volt adapter
   P/N. YU-39991
   90890-03169
5. Compression gauge
   P/N. YU-33223
   90890-06751
6. Timing light
   P/N. YM-33277-A
   90890-03141
7. Tachometer
   P/N. YU-8036-A
   90890-06760
8. Mity Vac
   P/N. YB-35956
   90890-06756
9. Backlash indicator
   P/N. YB-6265
   90890-06706
10. Magnet base
    P/N. YU-34481
    90890-06705



REMOVAL AND INSTALLATION

1. Flywheel puller
   P/N. YB-6117
   90890-06521
2. Stopper guide plate
   P/N. 90890-06501
3. Flywheel holder
   P/N. YB-6139
   90890-06522
4. Drive shaft holder
   P/N. YB-6228
   90890-06515
5. Piston ring installer
   P/N. YB-34454
   90890-06529
6. Bearing separator
   P/N. YB-6219
   90890-06534
7. Shaft holder
   P/N. 90890-06069
8. Bearing puller
   P/N. 90890-06535
9. Valve spring compressor
   P/N. YM-1253
   90890-04019
10. Valve guide remover
    P/N. YM-1122
    90890-06801
11. Stopper guide stand
    P/N. 90890-06538
12. Valve guide installer
    P/N. YB-6308
    90890-06802
13. Drive rod
    P/N. YB-6229, YB-6071
    90890-06602
    90890-06604
    90890-06605
    90890-06606



14. Needle bearing attachment (T9.9/F9.9A)
    P/N. YB-6298
    90890-06618
15. Valve guide reamer
    P/N. YM-1196
    90890-06804
16. Needle bearing attachment
    (F8B, F9.9/F9.9B)
    P/N. YB-6230, YB-6081
    90890-06617
    90890-06616
17. Valve seat cutter set
    P/N. YM-91043-C
    90890-06803
18. Valve adjuster
    P/N. YM-8035
    90890-01311
19. Oil seal installer
    P/N. YB-6022
20. Pinion nut holder
    P/N. YB-6078
21. Bearing installer
    P/N. YB-6015, YB-6085
    90890-06632
    90890-06625
22. Pinion height gauge (T9.9/FT9.9A)
    P/N. YB-6299
23. Pinion height gauge (F8B, F9.9/F9.9B)
    P/N. YB-34232
24. Bearing housing puller
    P/N. YB-06234
    90890-06503
25. Slide hammer set
    P/N. YB-6096
26. Center bolt
    P/N. 90890-06504
27. Shimming plate
    P/N. 90890-06701
28. Bearing depth plate
    P/N. 90890-06603

CHAPTER 2
SPECIFICATIONS

GENERAL SPECIFICATIONS 2-1

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GENERAL TORQUE SPECIFICATIONS 2-13

GENERAL SPECIFICATIONS

Item	Worldwide / USA, CANADA	Unit	Model F8BMH	Model F8BEH	Model F8BE
			—	—	—
Overall length		mm (in)	993 (39.1)		575 (22.6)
Overall width		mm (in)	430 (16.9)		325 (12.8)
Overall height	(S)	mm (in)	1,004 (39.5)		
	(L)	mm (in)	1,131 (44.5)		
	(X)	mm (in)	—		
Boat transom height	(S)	mm (in)	381 (15.0)		
	(L)	mm (in)	508 (20.0)		
	(X)	mm (in)	—		
Weight (without propeller)	(S)	kg (lb)	41.5 (91)	43.0 (95)	43.5 (96)
	(L)	kg (lb)	42.5 (94)	44.0 (97)	44.5 (98)
	(X)	kg (lb)	—		
Maximum output		kW (hp)@rpm	5.9 (8)@5,000		
Speed range at full-throttle		rpm	4,500 ~ 5,500		
Speed range at idling		rpm	950 ± 50		
Speed range at trolling		rpm	850 ± 50		
Maximum fuel consumption		ℓ / h (US/Imp gal)@rpm	3.3 (0.87/0.73)@5500		
Engine type			4 stroke OHC*1		
Number of cylinders			2		
Total displacement		cm^3 (cu. in)	232 (14.16)		
Bore and stroke		mm × mm (in × in)	59.0 × 42.4 (2.32 × 1.67)		
Compression ratio			9.3 : 1		
Spark plug		NGK number	CR5HS		
Number of carburetor			1		
Carburetor starting system			Prime start		
Manifold arrangement			Cross flow		
Exhaust system			Through propeller boss		
Lubrication system			Wet sump		
Ignition system			CDI		
Starting system			Manual starter	Electric starter	
Fuel rating		P.O.N.*2	86		
Engine oil type*3		SAE	10W-30, 10W-40		
		API	SE, SF, SE-SF, SE-SF-CC		
Engine oil pan capacity		ℓ (US/Imp qt)	1.0 (1.06/0.88)		
Gear oil type			Hypoid gear oil		
		SAE	90*4		
Gear oil capacity		cm^3 (US/Imp oz)	185 (6.25/6.51)		
Tilt angle at 12° boat transom		Degree	8, 12, 16, 20		
Tilt-up angle at 12° boat transom		Degree	70		
Shallow water angle		Degree	Tilt angle +20		—
Steering angle (left + right)		Degree	37 + 37		
Gear shift position			F-N-R*5		
Gear ratio			13 : 27 (2.08)		
Reduction system			Spiral bevel gear		
Propeller direction (rear view)			Clock wise		
Propeller drive system			Spline		

*1: Over head camshaft
*2: Pump Octane Number; (Research octane + Motor octane)/2
*3: YAMALUBE 4 is recommended
*4: GEAR CASE LUBE is recommended in USA
*5: Forward-Neutral-Reverse

GENERAL SPECIFICATIONS

Item	Worldwide / USA, CANADA		Unit	Model		
				FT9.9AMH	FT9.9AEH	FT9.9AE
				T9.9MH	T9.9EH	T9.9ER
Overall length			mm (in)	993 (39.1)		575 (22.6)
Overall width			mm (in)	430 (16.9)		325 (12.8)
Overall height		(S)	mm (in)	—		1,051 (41.4)
		(L)	mm (in)	1,178 (46.4)		
		(X)	mm (in)	1,254 (49.4)		
Boat transom height		(S)	mm (in)	—		381 (15.0)
		(L)	mm (in)	508 (20.0)		
		(X)	mm (in)	635 (25.0)		
Weight (without propeller)		(S)	kg (lb)	—		44.5 (98)
		(L)	kg (lb)	43.5 (96)	45.0 (99)	45.5 (100)
		(X)	kg (lb)	44.0 (97)	45.5 (100)	46.0 (101)
Maximum output			kW (hp)@rpm	7.3 (9.9)@4,500		
Speed range at full-throttle			rpm	4,000 ~ 5,000		
Speed range at idling			rpm	1,150 ± 50		
Speed range at trolling			rpm	1,000 ± 50		
Maximum fuel consumption			ℓ / h (US/Imp gal)@rpm	3.3 (0.87/0.73)@5,000		
Engine type				4 stroke OHC*1		
Number of cylinders				2		
Total displacement			cm^3 (cu. in)	232 (14.16)		
Bore and stroke			mm × mm (in × in)	59.0 × 42.4 (2.32 × 1.67)		
Compression ratio				9.3 : 1		
Spark plug			NGK number	CR6HS		
Number of carburetor				1		
Carburetor starting system				Prime start		
Manifold arrangement				Cross flow		
Exhaust system				Through propeller boss		
Lubrication system				Wet sump		
Ignition system				CDI		
Starting system				Manual starter	Electric starter	
Fuel rating			P.O.N.*2	86		
Engine oil type*3			SAE	10W-30, 10W-40		
			API	SE, SF, SE-SF, SE-SF-CC		
Engine oil pan capacity			ℓ (US/Imp qt)	1.0 (1.06/0.88)		
Gear oil type				Hypoid gear oil		
			SAE	90*4		
Gear oil capacity			cm^3 (US/Imp oz)	320 (10.82/11.26)		
Tilt angle at 12° boat transom			Degree	8, 12, 16, 20		
Tilt-up angle at 12° boat transom			Degree	70		
Shallow water angle			Degree	—		
Steering angle (left + right)			Degree	37 + 37		
Gear shift position				F-N-R*5		
Gear ratio				13 : 38 (2.92)		
Reduction system				Spiral bevel gear		
Propeller direction (rear view)				Clock wise		
Propeller drive system				Spline		

*1: Over head camshaft
*2: Pump Octane Number; (Research octane + Motor octane)/2
*3: YAMALUBE 4 is recommended
*4: GEAR CASE LUBE is recommended in USA
*5: Forward-Neutral-Reverse

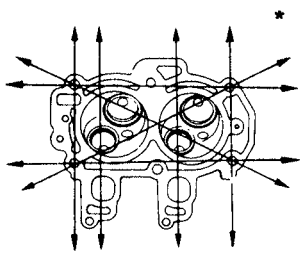
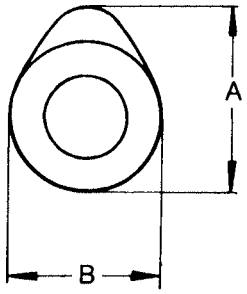
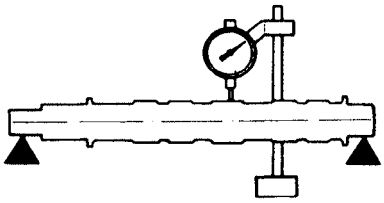
GENERAL SPECIFICATIONS

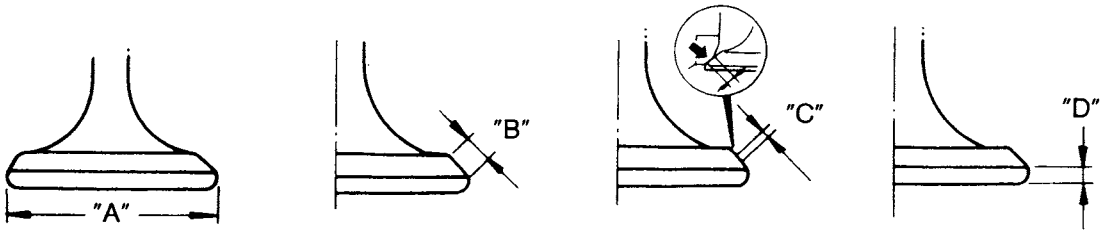
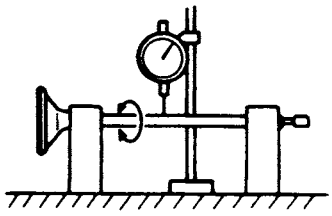
Item	Worldwide / USA, CANADA		Unit	Model		
				F9.9BMH	F9.9BEH	F9.9BE
				F9.9MH	F9.9EH	—
Overall length			mm (in)	863 (34.0)*1	993 (39.1)*2	575 (22.6)
Overall width			mm (in)	392 (15.4)*1	430 (16.9)*2	325 (12.8)
Overall height		(S)	mm (in)	1,004 (39.5)		
		(L)	mm (in)	1,131 (44.5)		
		(X)	mm (in)	—		
Boat transom height		(S)	mm (in)	381 (15.0)		
		(L)	mm (in)	508 (20.0)		
		(X)	mm (in)	—		
Weight (without propeller)		(S)	kg (lb)	41.5 (91)	43.0 (95)	43.5 (96)
		(L)	kg (lb)	42.5 (94)	44.0 (97)	44.5 (98)
		(X)	kg (lb)	—		
Maximum output			kW (hp)@rpm	7.3 (9.9)@5,000		
Speed range at full-throttle			rpm	4,500 ~5,500		
Speed range at idling			rpm	950 ± 50		
Speed range at trolling			rpm	850 ± 50		
Maximum fuel consumption			ℓ / h (US/Imp gal)@rpm	3.8 (1.00/0.84)@5,500		
Engine type				4 stroke OHC*3		
Number of cylinders				2		
Total displacement			cm^3 (cu. in)	232 (14.16)		
Bore and stroke			mm × mm (in × in)	59.0 × 42.4 (2.32 × 1.67)		
Compression ratio				9.3 : 1		
Spark plug			NGK number	CR6HS		
Number of carburetor				1		
Carburetor starting system				Prime start		
Manifold arrangement				Cross flow		
Exhaust system				Through propeller boss		
Lubrication system				Wet sump		
Ignition system				CDI		
Starting system				Manual starter	Electric starter	
Fuel rating			P.O.N.*4	86		
Engine oil type*5			SAE	10W-30, 10W-40		
			API	SE, SF, SE-SF, SE-SF-CC		
Engine oil pan capacity			ℓ (US/Imp qt)	1.0 (1.06/0.88)		
Gear oil type				Hypoid gear oil		
			SAE	90*6		
Gear oil capacity			cm^3 (US/Imp oz)	185 (6.25/6.51)		
Tilt angle at 12° boat transom			Degree	8, 12, 16, 20		
Tilt-up angle at 12° boat transom			Degree	70		
Shallow water angle			Degree	Tilt angle +20		—
Steering angle (left + right)			Degree	37 + 37		
Gear shift position				F-N-R*7		
Gear ratio				13 : 27 (2.08)		
Reduction system				Spiral bevel gear		
Propeller direction (rear view)				Clock wise		
Propeller drive system				Spline		

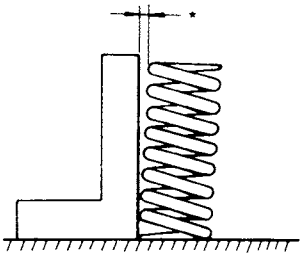
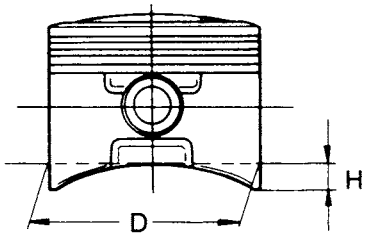
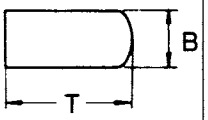
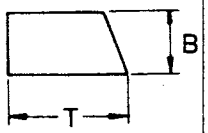
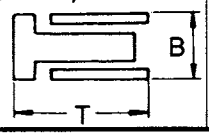
*1: Except for Europe and Canada
*2: For Europe and Canada
*3: Over head camshaft
*4: Pump Octane Number; (Research octane + Motor octane)/2
*5: YAMALUBE 4 is recommended
*6: GEAR CASE LUBE is recommended in USA
*7: Forward-Neutral-Reverse

MAINTENANCE SPECIFICATIONS

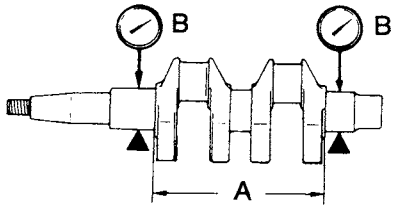
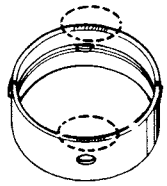
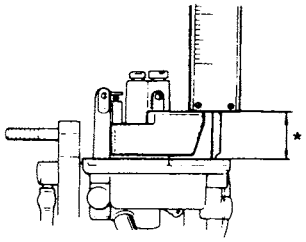
ENGINE

Item	Unit	Model		
		F8B	T9.9/FT9.9A	F9.9/F9.9B
CYLINDER HEAD:				
Warp limit 	mm (in)	0.1 (0.004) * Lines indicate straightedge measurement		
CYLINDER:				
Bore size	mm (in)	59.00 ~ 59.02 (2.323 ~ 2.324)		
Wear limit	mm (in)	59.1 (2.326)		
Taper limit	mm (in)	0.08 (0.003)		
CAMSHAFT:				
Cam dimensions				
Intake "A" 	mm (in)	24.541 ~ 24.641 (0.966 ~ 0.970)		
Intake "B"	mm (in)	20.137 ~ 20.237 (0.793 ~ 0.797)		
Exhaust "A"	mm (in)	24.578 ~ 24.678 (0.968 ~ 0.972)		
Exhaust "B"	mm (in)	20.178 ~ 20.278 (0.794 ~ 0.798)		
Camshaft runout limit 	mm (in)	0.1 (0.004)		
CAM BELT:				
Cam belt type		Cogged belt		
Belt stack	mm (in)	0 ~ 10 (0 ~ 0.4)		

Item		Unit	Model		
			F8B	T9.9/FT9.9A	F9.9/F9.9B
VALVE, VALVE SEAT, VALVE GUIDE:					
Valve clearance (cold):	IN.	mm (in)	0.15 ~ 0.20 (0.0059 ~ 0.0079)		
	EX.	mm (in)	0.20 ~ 0.25 (0.0079 ~ 0.0098)		
Valve dimensions					
					
"A" Head dia.	IN.	mm (in)	25.9 ~ 26.1 (1.020 ~ 1.028)		
	EX.	mm (in)	21.9 ~ 22.1 (0.862 ~ 0.870)		
"B" Face width	IN.	mm (in)	1.98 ~ 3.11 (0.078 ~ 0.122)		
	EX.	mm (in)	1.98 ~ 3.11 (0.078 ~ 0.122)		
"C" Seat width	IN.	mm (in)	0.6 ~ 0.8 (0.024 ~ 0.031)		
	EX.	mm (in)	0.6 ~ 0.8 (0.024 ~ 0.031)		
"D" Margin thickness	IN.	mm (in)	0.5 ~ 0.9 (0.020 ~ 0.035)		
	EX.	mm (in)	0.5 ~ 0.9 (0.020 ~ 0.035)		
Stem outside dia.	IN.	mm (in)	5.475 ~ 5.490 (0.2156 ~ 0.2161)		
	EX.	mm (in)	5.460 ~ 5.475 (0.2150 ~ 0.2156)		
Guide inside dia.	IN.	mm (in)	5.500 ~ 5.512 (0.2165 ~ 0.2170)		
	EX.	mm (in)	5.500 ~ 5.512 (0.2165 ~ 0.2170)		
Stem-to-guide clearance	IN.	mm (in)	0.010 ~ 0.037 (0.0004 ~ 0.0015)		
	EX.	mm (in)	0.025 ~ 0.052 (0.0010 ~ 0.0020)		
Stem runout limit		mm (in)	0.016 (0.0006)		
					

Item		Unit	Model		
			F8B	T9.9/FT9.9A	F9.9/F9.9B
VALVE SPRING:					
Set length (valve closed)	IN.	mm (in)	24.4 (0.96)		
	EX.	mm (in)	24.4 (0.96)		
Compressible forth	IN.	N (kg, lb)	90 ~ 100 (9.0 ~ 10.0, 19.8 ~ 22.0)		
(installed)	EX.	N (kg, lb)	90 ~ 100 (9.0 ~ 10.0, 19.8 ~ 22.0)		
Tilt limit *	IN.	mm (in)	1.1 (0.043)		
	EX.	mm (in)	1.1 (0.043)		
Direction of winding	IN.		Left hand		
	EX.		Left hand		
PISTON:					
Piston to cylinder clearance		mm (in)	0.035 ~ 0.065 (0.0014 ~ 0.0026)		
Piston side "D"		mm (in)	58.950 ~ 58.965 (2.3209 ~ 2.3215)		
Measuring point "H"		mm (in)	10 (0.39)		
					
Oversize	1st	mm (in)	59.25 (2.333)*1		
	2nd	mm (in)	59.50 (2.343)		
PISTON RING:					
Top ring:					
Type			Plain (barrel face)		
Dimensions (B × T) 		mm (in)	1.5 × 2.3 (0.06 × 0.09)		
End gap (installed)		mm (in)	0.15 ~ 0.30 (0.006 ~ 0.012)		
Limit		mm (in)	0.50 (0.020)		
Side clearance (installed)		mm (in)	0.04 ~ 0.08 (0.002 ~ 0.003)		
2nd ring:					
Type			Plain (taper face)		
Dimensions (B × T) 		mm (in)	1.5 × 2.4 (0.06 × 0.09)		
End gap (installed)		mm (in)	0.15 ~ 0.30 (0.006 ~ 0.012)		
Limit		mm (in)	0.50 (0.020)		
Side clearance (installed)		mm (in)	0.03 ~ 0.07 (0.001 ~ 0.003)		
Oil ring: 					
Dimensions (B × T)		mm (in)	2.4 × 2.5 (0.09 × 0.10)		
End gap (installed)		mm (in)	0.20 ~ 0.70 (0.008 ~ 0.028)		

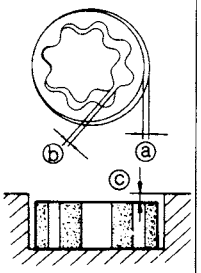
*1: Except for USA

Item	Unit	Model		
		F8B	T9.9/FT9.9A	F9.9/F9.9B
CONNECTING ROD:				
Oil clearance (big end)	mm (in)	0.021 ~ 0.045 (0.0008 ~ 0.0018)		
CRANKSHAFT:				
				
Crank width "A"	mm (in)	123.7 ~ 123.9 (4.87 ~ 4.88)		
Runout limit "B"	mm (in)	0.05 (0.002)		
Main bearing clearance	mm (in)	0.000 ~ 0.027 (0.0000 ~ 0.0011)		
Crankcase mark-Bearing color		A-Blue, B-Black, C-Brown		
				
CARBURETOR:				
Stamped mark		6J606*1 6J710*2	6G805*1 6G810*2 6G820*3	6G905*1 6G810*2 6G920*3
Main Nozzle	mm (in)	2.2 (0.087)		
Main Jet (M.J.)	#	86*4, 82*2		
Pilot Jet (P.J.)	#	48		
Pilot Screw (turn out) (P.S.)	turns	3-1/2 ± 1	3 ± 1*1	3-1/2 ± 1*1
			— *2, 3	
Valve seat size (V.S.)	mm (in)	ø1.2 (0.047)		
Float height*	mm (in)	25.5 ± 1 (1 ± 0.04)		
				
Idling speed	r/min	950 ± 50	1,150 ± 50	950 ± 50
Trolling speed	r/min	850 ± 50	1,000 ± 50	850 ± 50
THERMOSTAT:				
Valve opening temperature	°C (°F)	58 ~ 62 (136 ~ 144)		
Full open temperature	°C (°F)	70 (158)		
Valve lift (at full open temp.)	mm (in)	3 (0.12)		

*1: Except for USA and Switzerland
*2: For Switzerland
*3: For USA
*4: Except for Switzerland

MAINTENANCE SPECIFICATIONS

Item	Unit	Model		
		F8B	T9.9/FT9.9A	F9.9/F9.9B
FUEL PUMP:				
Consumption	ℓ /h, r/min	Min 18.0, 2,750		
Diaphragm stroke	mm (in)	2.4 (0.0945)		
Plunger stroke	mm (in)	5.8 (0.2283)		
LUBRICATION SYSTEM:				
Oil filter type:		Steel mesh		
Oil pump type:		Trochoid type		
Outer rotor to housing ⓐ	mm (in)	0.06 ~ 0.11 (0.0024 ~ 0.0043)		
Inner rotor to outer rotor ⓑ	mm (in)	0.02 ~ 0.15 (0.0008 ~ 0.0059)		
Rotor to housing ⓒ	mm (in)	0.02 ~ 0.07 (0.0008 ~ 0.0028)		
Relief valve operation pressure	kpa (kg/cm², psi)	388 ~ 450 (3.88 ~ 4.50, 55.19 ~ 64.00)		



LOWER

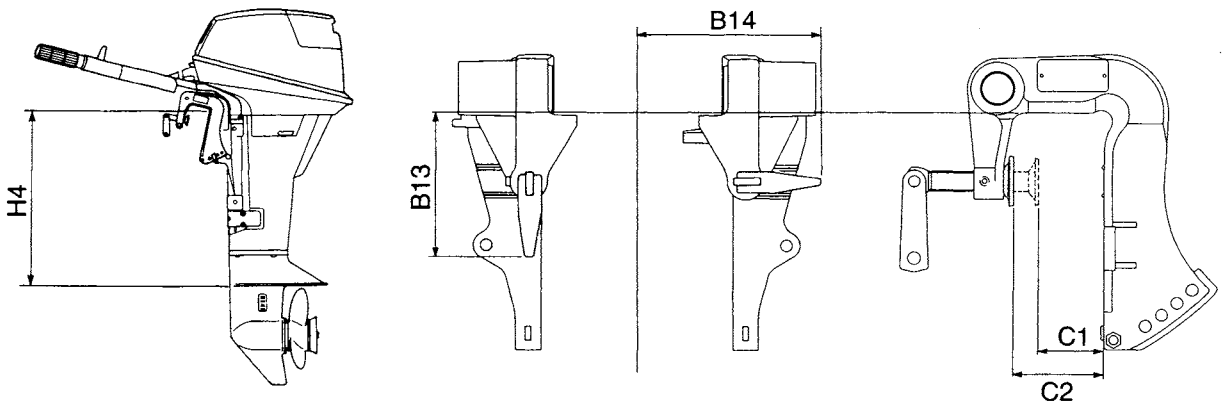
Item	Unit	Model		
		F8B	T9.9/FT9.9A	F9.9/F9.9B
GEAR BACKLASH:				
Pinion - forward	mm (in)	0.23 ~ 0.70 (0.009 ~ 0.028)	0.26 ~ 0.77 (0.010 ~ 0.030)	0.23 ~ 0.70 (0.009 ~ 0.028)
Pinion - reverse	mm (in)	0.82 ~ 1.16 (0.032 ~ 0.046)	0.51 ~ 1.02 (0.020 ~ 0.040)	0.82 ~ 1.16 (0.032 ~ 0.046)
Pinion shims	mm	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50	0.10/0.14/0.18/ 0.35/0.50	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50
Forward shims	mm	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50	0.10/0.14/0.18/ 0.50	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50
Reverse shims	mm	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50	0.10/0.14/0.18/ 0.35/0.50	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50
PROPELLER:				
T9.9/FT9.9A				
Material		Plastic (R)		
No. of blades × diameter × pitch				
Size 1 (6G8-45941-00)	in	3 × 11-3/4 × 11		
Size 2 (6G8-45943-00)	in	3 × 11-3/4 × 9-1/4		
Dual thrust				
Size 3 (6G8-45945-00)	in	3 × 11-3/4 × 12-1/4		
Size 4 (6G8-45947-00-EL)	in	3 × 11-3/4 × 9-1/4		
Test propeller 1 (90890-01627)	r/min	4,000 ~ 4,200		
Test propeller 2 (YB-01627)	r/min	4,000 ~ 4,200		
F8B, F9.9/F9.9B				
Material		Aluminum		
No. of blades × diameter × pitch				
Size 1 (683-45949-00-EL)	in	3 × 9-1/2 × 6-1/2		
Size 2 (683-45947-00-EL)	in	3 × 9-1/4 × 8		
Size 3 (683-45945-00-EL)	in	3 × 9-1/4 × 9		
Size 4 (683-45952-00-EL)	in	3 × 9-1/4 × 9-3/4		
Size 5 (683-45943-00-EL)	in	3 × 9-1/4 × 10-1/2		
Size 6 (683-45941-00-EL)	in	3 × 9-1/4 × 12		
Dual thrust				
Size 7 (683-W4591-02-EL)	in	3 × 9-3/4 × 8		
Size 8 (683-W4592-02-EL)	in	3 × 9-3/4 × 6-1/2		
Test propeller 1 (90890-01619)	r/min	3,950 ~ 4,150		
Test propeller 2 (YB-01619)	r/min	3,950 ~ 4,150		

ELECTRICAL

Item	Unit	Model			
		F8B	T9.9/FT9.9A	F9.9/F9.9B	
IGNITION SYSTEM:					
Ignition timing (full retard)	Degrees	5 ± 3 BTDC*1			
(full advance)	Degrees	35 ± 3 BTDC*1			
Piston position	mm (in)	4.78 ± 0.76 (0.188 ± 0.030)			
CDI output peak voltage (minimum):					
(O – B) open	V@cranking	85	95	85	
connected	V@cranking	85	90	85	
	V@1,500 r/min	195	205	195	
	V@3,500 r/min	170	195	170	
Charge coil output peak voltage (minimum):					
(Br – L) open	V@cranking	95	100	95	
connected	V@cranking	90	150	90	
	V@1,500 r/min	205	220	205	
	V@3,500 r/min	180	210	180	
Pulser coil output peak voltage (minimum):					
(W/R – B) open	V@cranking	3.5	4.0	3.5	
connected	V@cranking	2.5	2.5	2.5	
	V@1,500 r/min	7.5	7.5	7.5	
	V@3,500 r/min	13.0	12.0	13.0	
Spark plug gap	mm (in)	0.6 ~ 0.7 (0.024 ~ 0.028)			
IGNITION CONTROL SYSTEM:					
Oil pressure switch (continue)	kPa (kg/cm², psi)	0 ± 10 (0 ± 0.1, 0 ± 1.4)			
(discontinue)	kPa (kg/cm², psi)	60 ± 10 (0.6 ± 0.1, 8.5 ± 1.4)			
Oil pressure indicator lamp output	V	More than 65			
STARTING SYSTEM:					
Fuse	V - A	12 - 20			
Starter motor					
Output	kW	0.6			
Brush length	mm (in)	9.0 ~ 12.5 (0.35 ~ 0.49)			
Commutator diameter	mm (in)	29.0 ~ 30.0 (1.14 ~ 1.18)			
Commutator under cut	mm (in)	0.2 ~ 0.8 (0.01 ~ 0.03)			
Rating	Sec.	30			
CHARGING SYSTEM:		G – G	G – G	W/G – B	G – G
Lighting coil output	V@cranking	7.5	9.0	8.0	7.5
	V@cranking	8.0	9.0	8.0	8.0
	V@1500 r/min	30	35	30	30
	V@3500 r/min	65	75	65	60
ENRICHMENT CONTROL SYSTEM:					
Valve heater coil resistance at 20°C (68°F)	Ω	0.24 ~ 0.36			

*1: Before top dead center

DIMENSION

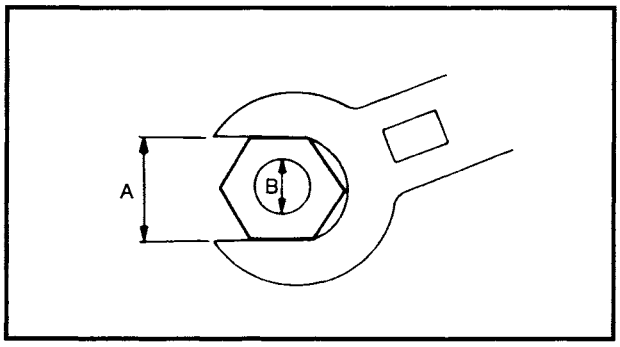


Symbol (used in diagram)		Unit	Model	
			T9.9/FT9.9A	F8B, F9.9/F9.9B
H4	S	mm (in)	432 (17.0)	
	L	mm (in)	559 (22.0)	
	UL	mm (in)	635 (25.0)	—
B13		mm (in)	114 (4.5)	
B14		mm (in)	126 (5.0)	
C1		mm (in)	33 (1.3)	
C2		mm (in)	65 (2.6)	

TIGHTENING TORQUE

Part to be tightened		Part name	Thread size	Q'ty	Tightening torque			Remarks
					Nm	m • kg	ft • lb	
ENGINE:								
Connecting rod	1st	Bolt	M6	4	6	0.6	4.3	E
	2nd				12	1.2	8.7	
Crankcase	1st	Bolt	M6	6	6	0.6	4.3	E
	2nd				12	1.2	8.7	
	1st	Bolt	M8	4	15	1.5	11	E
	2nd				30	3.0	22	
Cylinder head	1st	Bolt	M8	6	15	1.5	11	E
	2nd				30	3.0	22	
Oil element assembly		—	M24	1	8	0.8	5.8	
Exhaust cover		Bolt	M6	7	12	1.2	8.7	
Rock arm adjusting screw		Lock nut	M5	4	8	0.8	5.8	
Drive gear		Nut	M24	1	23	2.3	17	
Driven gear		Bolt	M6	1	13	1.3	9.4	
Flywheel		Nut	M12	1	100	10.0	7.2	E
Spark plug		—	M10	2	13	1.3	9.4	
Engine unit mounting		Bolt	M8	6	21	2.1	15	
UPPERCASE AND GEAR CASE:								
Pinion nut		Nut	M8	1	26	2.6	19	
Exhaust guide mounting		Bolt	M6	2	10	1.0	7.2	
Relief valve		—	M14	1	8	0.8	5.8	
Bracket bolt		Nut	M8	1	17	1.7	12	
Steering bracket		Bolt	M6	2	13	1.3	9.4	572
Upper side mount rubber		Nut	M8	2	25	2.5	18	
Propeller	T9.9/FT9.9A	Nut	M10	1	21	2.1	15	
	F8B, F9.9/F9.9B			1	17	1.7	12	
Plug drain		—	M18	1	8	0.8	5.8	
Manifold exhaust mounting		Bolt	M6	2	12	1.2	8.7	
Bottom cowling mounting		Bolt	M8	6	21	2.1	15	

Nut (A)	Bolt (B)	General torque specifications		
		Nm	m • kg	ft • lb
8 mm	M5	5.0	0.5	3.6
10 mm	M6	8.0	0.8	5.8
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	26
17 mm	M12	43	4.3	31



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GENERAL TORQUE SPECIFICATIONS

This chart specifies the torque for tightening standard fasteners with standard clean dry ISO threads at room temperature. Torque specifications for special components or assemblies are given in applicable sections of this manual. To avoid causing warpage, tighten multi-fastener assemblies in a crisscross fashion and in progressive stages until the specified torque is reached.

CHAPTER 3
PERIODIC INSPECTION AND ADJUSTMENT

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PERIODIC SERVICE

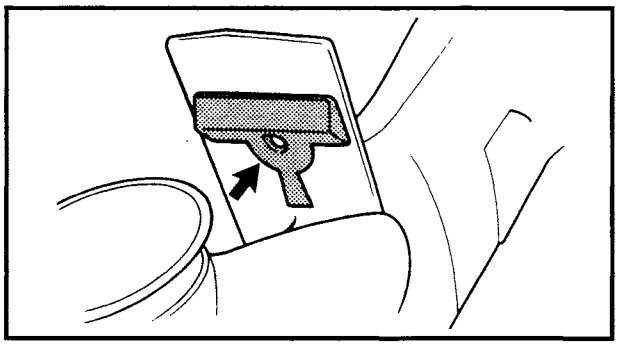
MAINTENANCE SCHEDULE

The following chart may be taken as a helpful guide to the intervals between maintenance procedures.

Item	Remarks	Initial		Every		Refer page
		10 hours (Break-in)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
Anode	Inspect	○	○	○		3-1
Battery	Check	○ (every 1 month)				3-2
Bolts and nuts	Retighten	○		○		—
Carburetor	Clean/Adjust	○		○		—
Cooling water passages	Clean		○	○		—
Engine oil	Replace	○		○		3-3
Fuel strainer	Inspect/Replace	○	○	○		—
Fuel tank	Clean				○	—
Gear oil	Replace	○		○		3-5
Greasing points	Grease			○		—
Idle speed	Adjust			○		3-13
Ignition timing	Check	○		○		3-15
Oil filter	Clean	○		○		3-4
	Replace				○	
Outboard motor body	Inspect		○	○		—
Propeller	Inspect		○	○		3-2
Spark plug	Clean/Adjust	○	○	○		3-6
Timing belt	Check			○		3-7
Throttle link	Adjust	○		○		3-14
Valve clearance	Measure/Adjust	○		○		3-8

ANODE

1. Inspect:
   - Anode
     Wear/Damage → Replace.



CAUTION:

Do not paint the anode, or the outboard may be corroded.

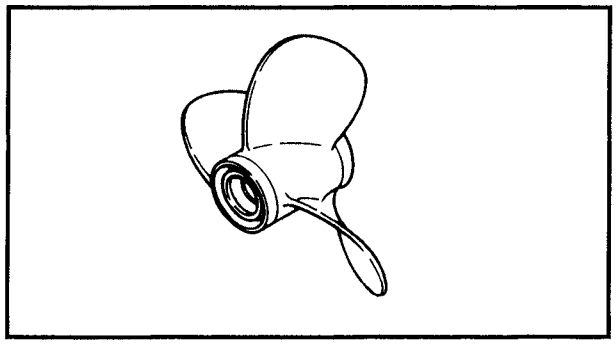
2. Clean:
   - Anode
     Use a wire brush.

NOTE:

Remove all trace of oil or grease. After cleaning, polish the contact surfaces of the anode mount and re-install.

CAUTION:

Never paint the anode. To ensure good electrical contact, keep the anode contact surface clean of oil or grease.



PROPELLER

1. Inspect:
   - Propeller
   - Spline

   Wear/Damage → Replace.

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BATTERY

⚠ WARNING

Battery electrolyte is dangerous; it contains sulfuric acid which is poisonous and highly caustic.
Always follow these preventive measures:
- **Avoid bodily contact with electrolyte as it can cause severe burns or permanent eye injury.**
- **Wear protective eye gear when handling or working near batteries.**

Antidote (EXTERNAL):
- **SKIN - Wash with water.**
- **EYES - Flush with water for 15 minutes and get immediate medical attention.**

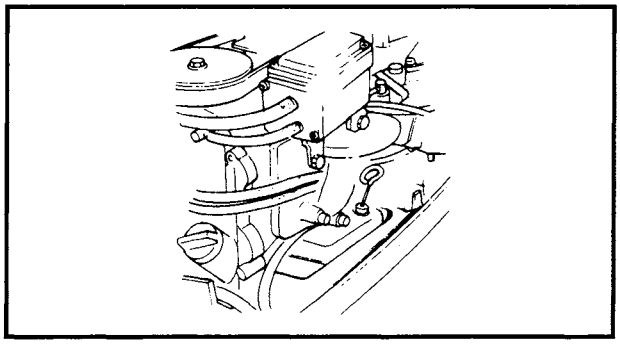
Antidote (INTERNAL):
- **Drink large quantities of water or milk followed with milk of magnesia, beaten egg or vegetable oil. Get immediate medical attention.**

Batteries generate explosive, hydrogen gas.
Always follow these preventive measures:
- **Charge batteries in a well-ventilated area.**
- **Keep batteries away from fire, sparks or open flames (e.g., welding equipment, lighted cigarettes).**
- **DO NOT SMOKE when charging or handling batteries.**

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

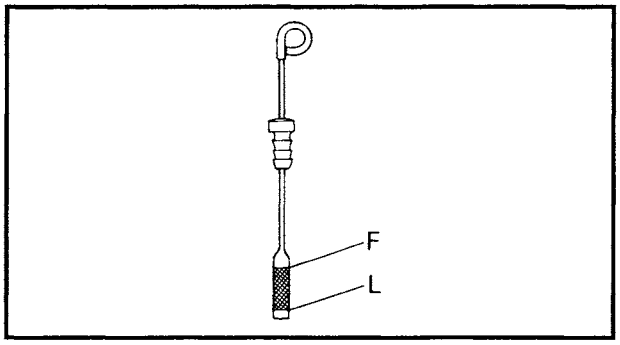
NOTE:
- Batteries very among manufacturers. Therefore, the following procedures may not always apply. Consult your battery manufacturer's instructions.
- Disconnect the black negative lead first to prevent the risk of shorting.

1. Inspect:
   - Battery fluid level
   - Battery fluid specific gravity



ENGINE OIL LEVEL CHECK

1. Place the outboard motor in an upright position.

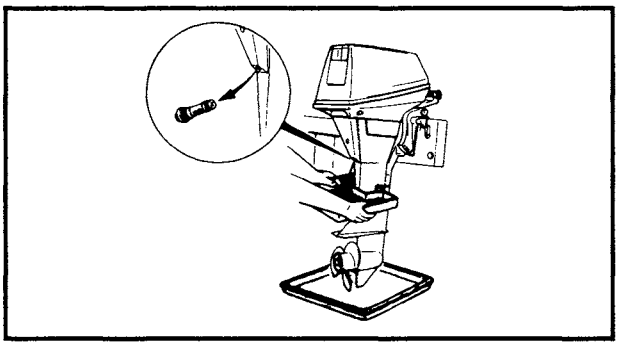


2. Check:
   - Engine oil level
     Oil level should be between the maximum F and minimum L marks.
     Oil level is low → Add oil to proper level.

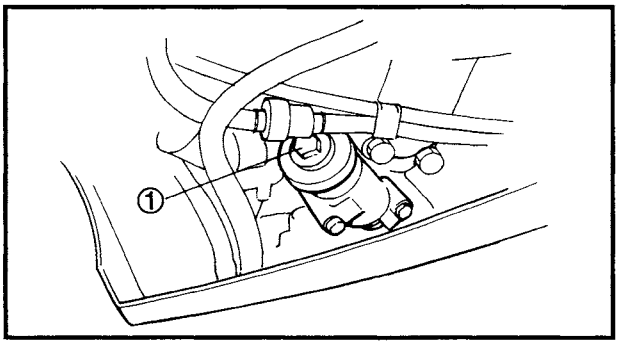
Recommended oil:
SAE: 10W-30, 10W-40
API: SE, SF, SE-SF, SE-SF-CC

ENGINE OIL REPLACEMENT

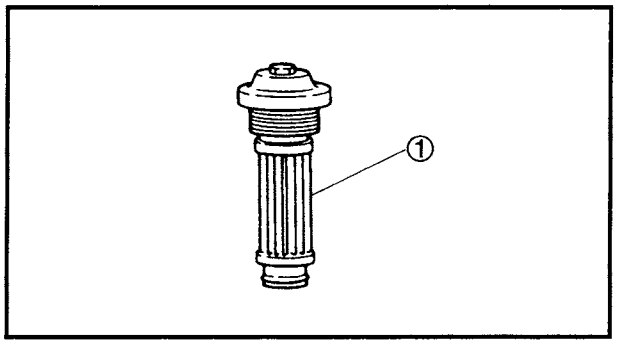
1. Place the outboard motor in an upright position.
2. Place a suitable container under the outboard motor.



3. Remove:
   - Oil filler cap
   - Drain bolt
     Drain the engine oil.

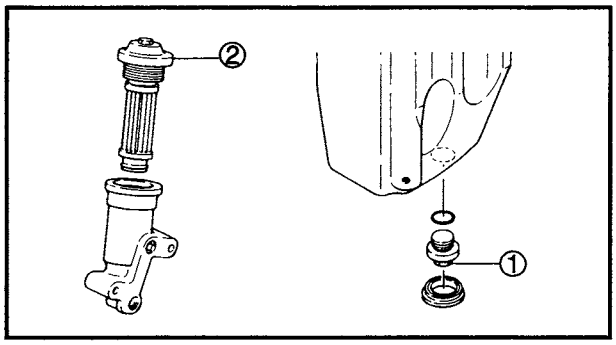


4. Remove:
   - Oil filter assembly ①



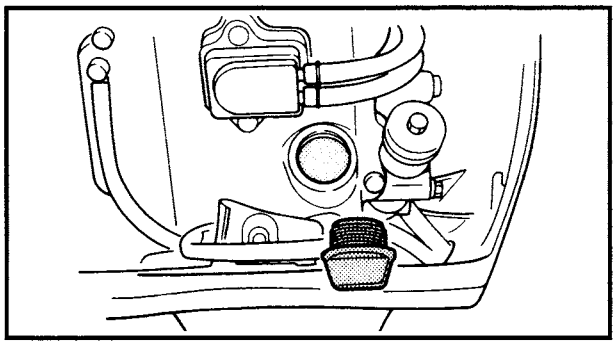
5. Inspect:
   - Oil filter element ①
     Damage → Replace.
     Foul/Clog → Clean.

6. Clean:
   - Oil filter element
     Blow out dust in the element from the outer surface using compressed air.



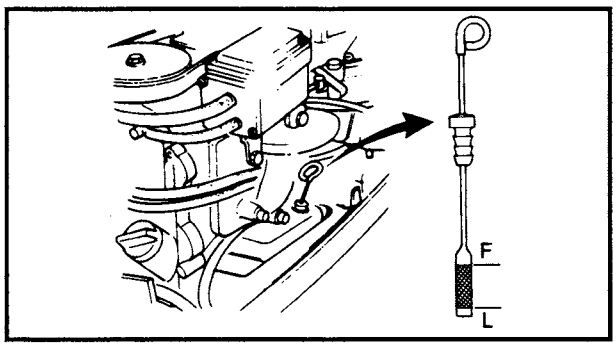
7. Install:
   - Drain bolt ①
   - Oil filter assembly ②

Drain bolt:
8 Nm (0.8 m • kg, 5.8 ft • lb)
Oil filter assembly:
8 Nm (0.8 m • kg, 5.8 ft • lb)



8. Fill:
   - Engine oil

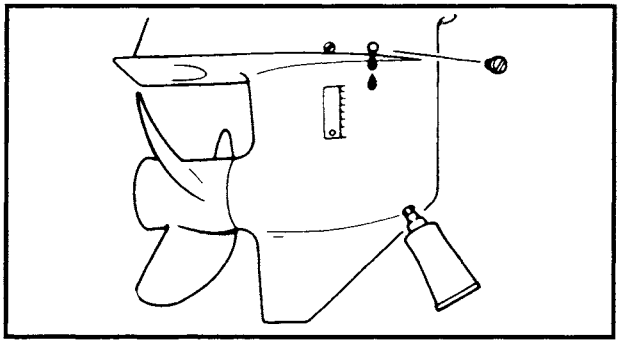
Recommended oil:
SAE: 10W-30, 10W-40
API: SE, SF, SE-SF, SE-SF-CC
Oil capacity:
1.0 ℓ (1.06 US qt, 0.88 Imp qt)



9. Check:
   - Engine oil level
     Refer to page 3-3.
10. Install:
    - Oil filler cap

GEAR OIL LEVEL CHECK

1. Place the outboard motor in an upright position.
2. Check:
   - Gear oil level
     Oil level is low → Add oil to proper level.



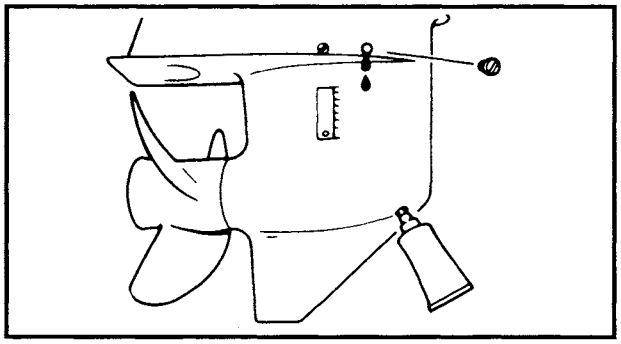
Checking steps:
- Remove the oil drain and oil level plugs.
- Add the gear oil through the oil drain hole until it over flows from the oil level hole.

Recommended oil:
Hypoid gear oil (SAE 90)

- Install the oil level plug.
- Install the oil drain plug.

GEAR OIL REPLACEMENT

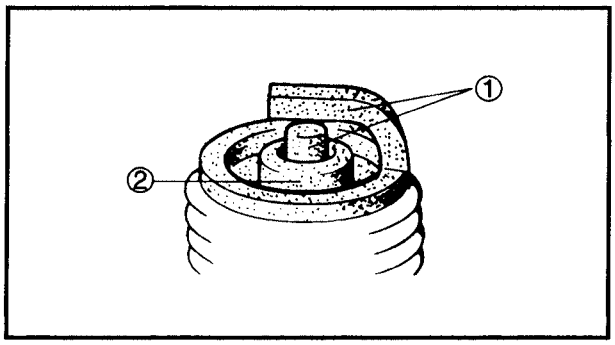
1. Place the outboard motor in an upright position.
2. Place a suitable container under the outboard motor.
3. Remove:
   - Oil drain plug
   - Oil level plug
     Drain the gear oil.



4. Fill:
   - Gear oil

Recommended oil:
Hypoid gear oil (SAE 90)
Oil capacity
T9.9/FT9.9A:
320 m³
(10.82 us oz, 11.26 Imp oz)
F8B, F9.9/F9.9B:
185 m³
(6.25 us oz, 6.51 Imp oz)

5. Check:
   - Gear oil level
6. Install:
   - Oil level plug
   - Oil drain plug



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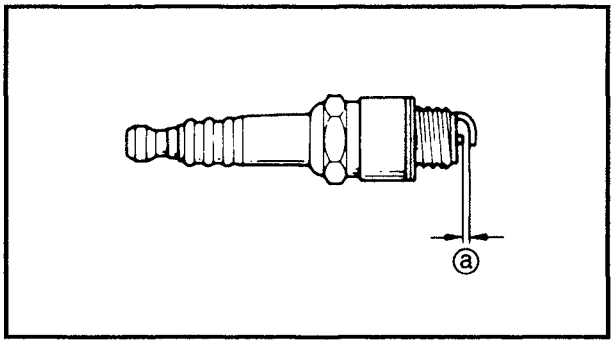
SPARK PLUG

1. Remove:
   - Spark plug
2. Inspect:
   - Electrode ①
     Wear/Damage → Replace.
   - Insulator color ②
     Distinctly different color → check the engine condition.

Color guide
Medium to light tan color:
Normal
Whitish color: Lean fuel mixture
Plugged fuel mixture
Air leak
Wrong settings
Blackish color: Excessive idling
Electrical malfunction
rich carburetion
Defective spark plug

3. Clean:
   - Spark plug
     Clean the spark plug with a spark plug cleaner or wire brush.
4. Inspect:
   - Spark plug type
     Incorrect → Replace.

Standard spark plug:
NGK CR5HS (F8B)
NGK CR6HS
(T9.9/FT9.9A, F9.9/F9.9B)

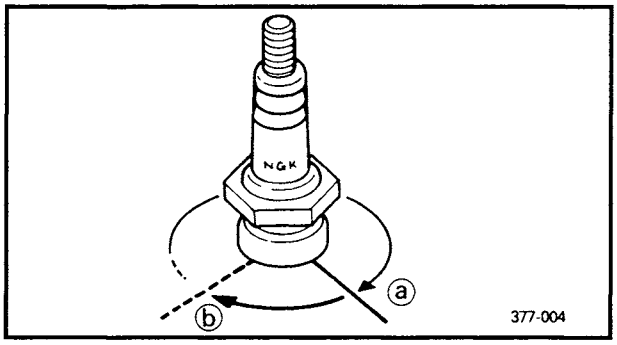


5. Measure:
   - Spark plug gap ⓐ
     Out of specification → Regap.
     Use a wire gauge.

Spark plug gap:
0.6 ~ 0.7 mm (0.024 ~ 0.028 in)

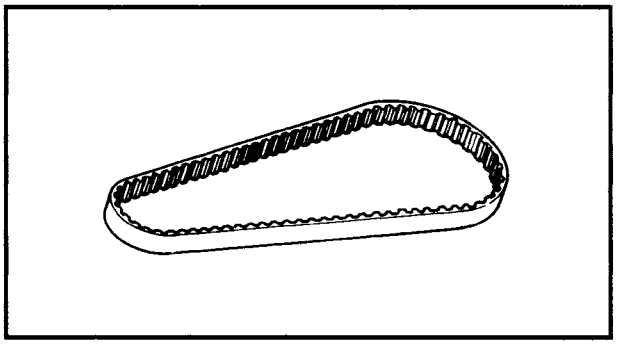
6. Tighten:
   - Spark plug

NOTE:
Before installing a spark plug, clean the gasket surface and plug surface. Also it is suggested to apply a thin film of Anti Seize Compound to the spark plug thread to prevent future thread seizure.



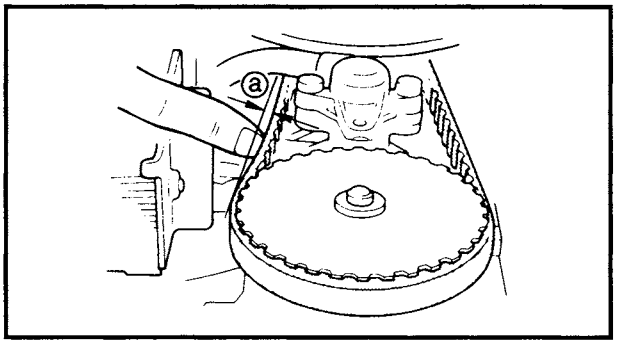
	Spark plug: **13 Nm (1.3 m • kg, 9.4 ft • lb)**

NOTE:
If a torque wrench is not available when you are installing a spark plug, a good estimate of the correct torque is 1/4 to 1/2 turns ⓑ part finger tight ⓐ. Have the spark plug torqued to the correct valve as soon as possible with a torque wrench.



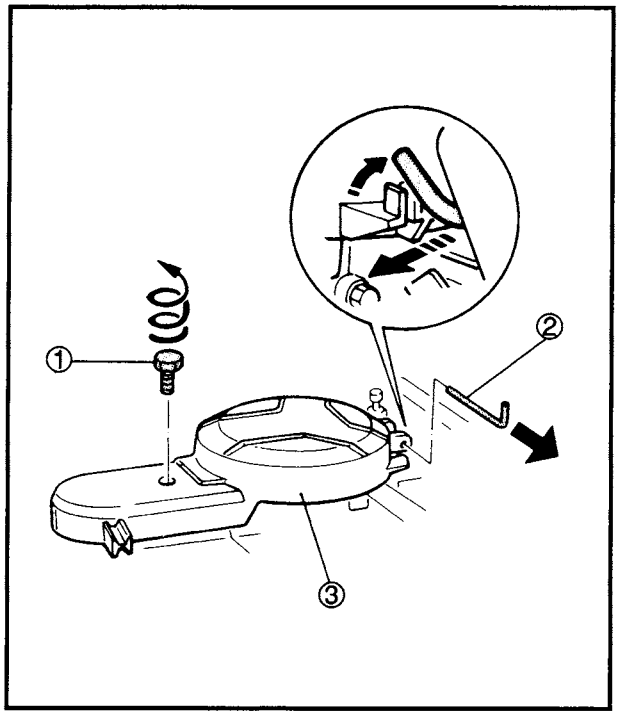
TIMING BELT

1. Inspect:
   - Timing belt
     Wear/Damage → Replace.



2. Check:
   - Timing belt slack ⓐ
     Push the timing belt with your finger.
     Out of specification → Replace.

	Timing belt slack: **0 ~ 10 mm (0 ~ 0.4 in)**

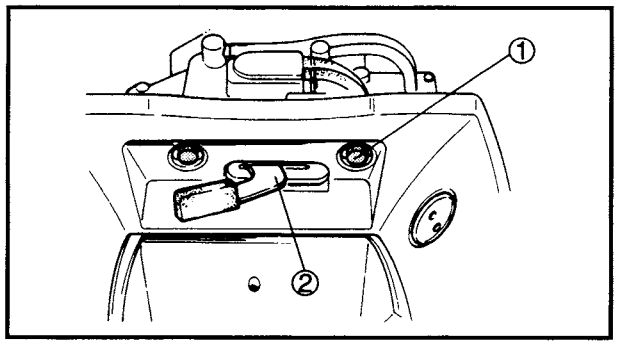


VALVE CLEARANCE ADJUSTMENT

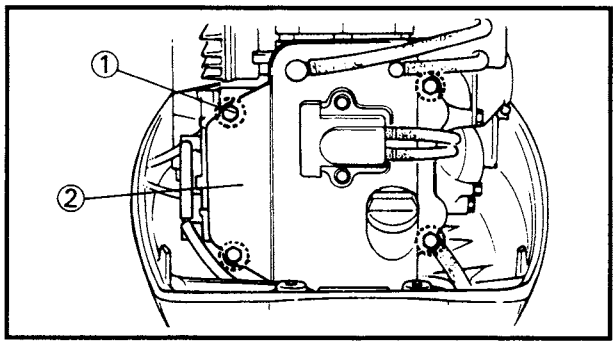
NOTE:

- The valve clearance must be adjusted when the engine is cool to the touch.
- Adjust the valve clearance when the piston is at the Top Dead Center (T.D.C.) on compression stroke.

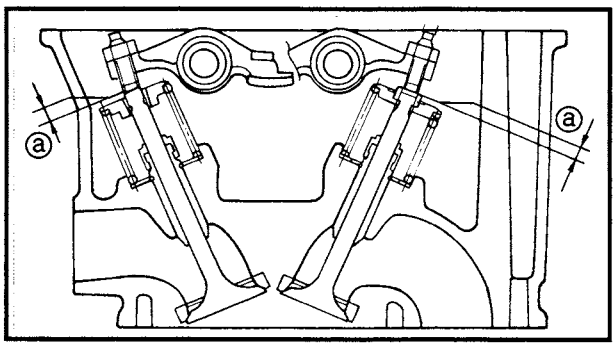
1. Remove:
   - Screw ①
   - Hinge pin ②
   - Flywheel cover ③



2. Remove:
   - Bolt ①
   - Clamp lever ②

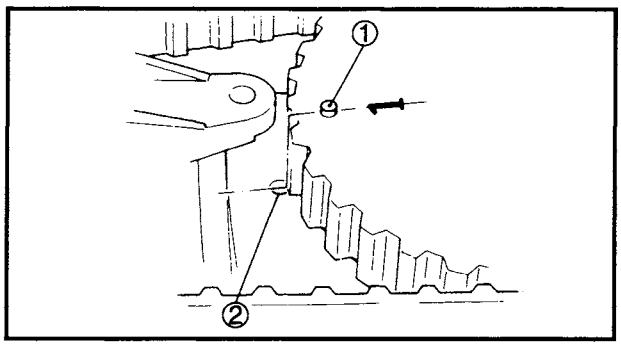


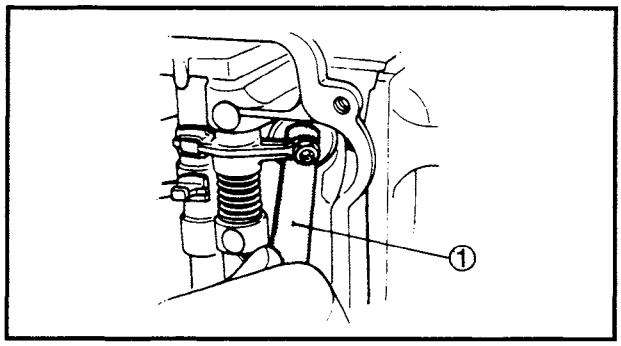
3. Remove:
   - Hose
   - Bolt ①
   - Cylinder head cover ②

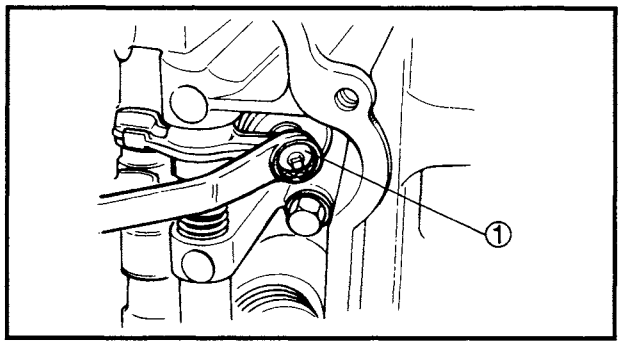


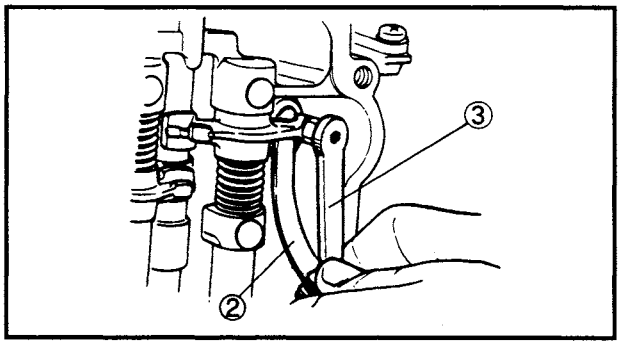
4. Measure:
   - Valve clearance ⓐ
     Out of specification → Adjust.

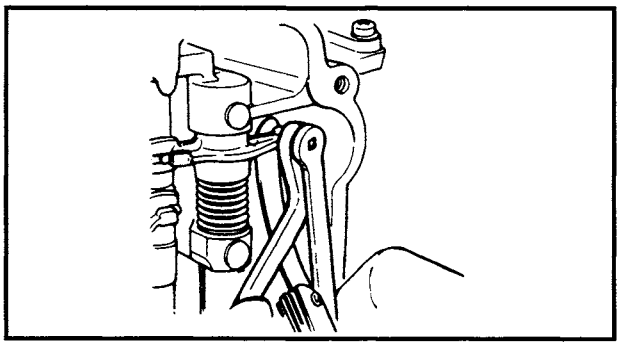
Valve clearance (cold):
Intake: 0.15 ~ 0.20 mm (0.0059 ~ 0.0079 in)
Exhaust: 0.20 ~ 0.25 mm (0.0079 ~ 0.0098 in)











Measurement steps:
- Turn the crankshaft clockwise.
- Align the "1" on the driven gear ① with the mark on the cylinder head ② when #1 piston is at TDC on compression stroke.

NOTE:
When measuring the valve clearance at the #2 cylinder, turn the driven gear 180° so that the "2" marked on the driven gear aligns with the mark on the cylinder head.

- Measure the valve clearance using a feeler gauge ①.

5. Adjust:
   - Valve clearance

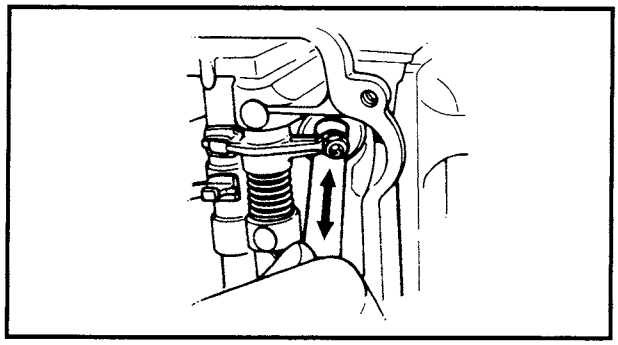
Adjustment steps:
- Loosen the lock nut ①.
- Insert the specified feeler gauge ② into the clearance between the valve stem end and the adjust bolt.
- Adjust the adjust bolt using a valve adjuster ③.

Valve adjuster:
YM-08035/90890-01311

- Tighten the lock nut with the feeler gauge inserted.

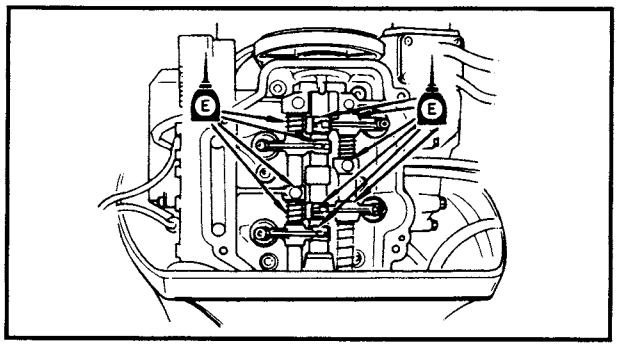
Lock nut:
8 Nm (0.8 m • kg, 5.8 ft • lb)

NOTE:
Lock the adjust bolt so that it does not move.

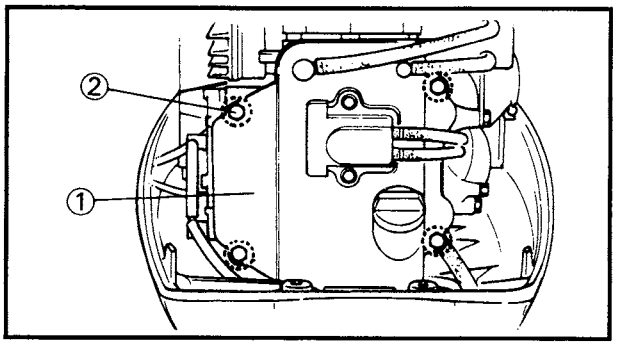


6. Measure:
   - Valve clearance
     Out of specification → Readjust.

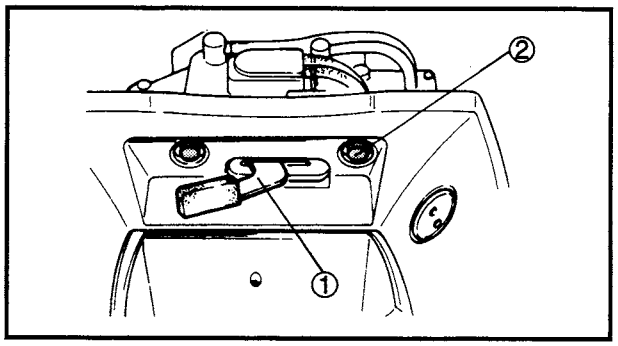
NOTE:
If too loose or too tight, readjust the valve clearance.



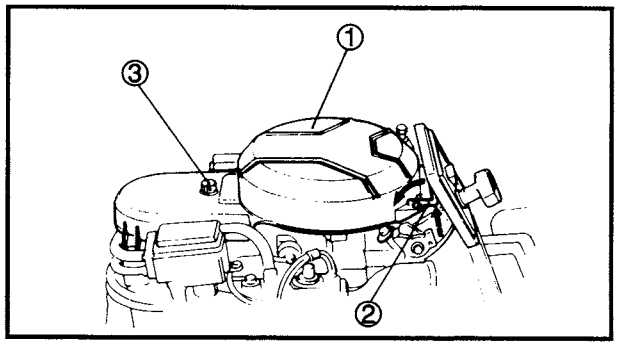
7. Apply:
   - Engine oil
     To valve stem and adjust bolt.



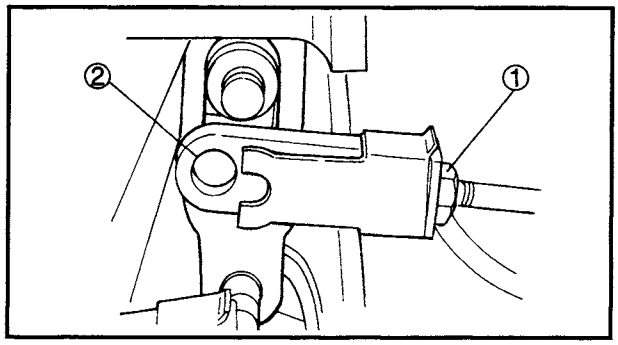
8. Install:
   - Seal
   - Cylinder head cover ①
   - Bolt ②
   - Hose



9. Install:
   - Clamp lever ①
   - Bolt ②



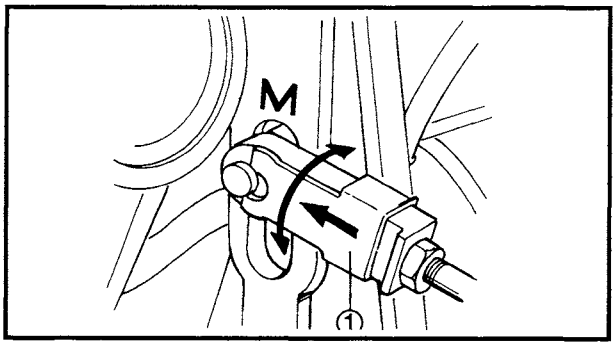
10. Install:
    - Flywheel cover ①
    - Hinge pin ②
    - Collar
    - Screw ③



SHAFT CABLE ADJUSTMENT

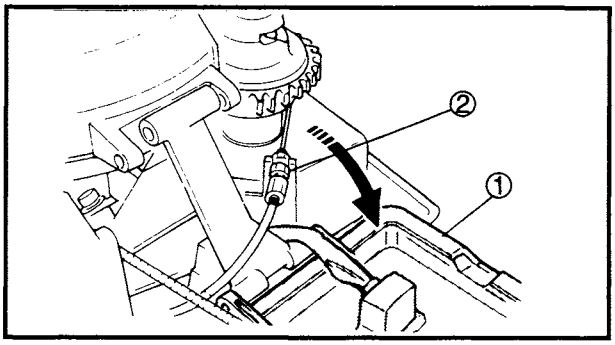
1. Adjust:
   - Shift cable length

Adjustment steps:
- Loosen the lock nut ①.
- Remove the cable end ②.
- Set the shift lever to neutral.
- Set the shift arm to neutral.
- Turn the cable end in or out until adjustment is suitable.
- Fit the cable end to the pin marked with "M" on the shift arm.
- Push the cable end stopper ① to secure the cable end.
- Tighten the lock nut.



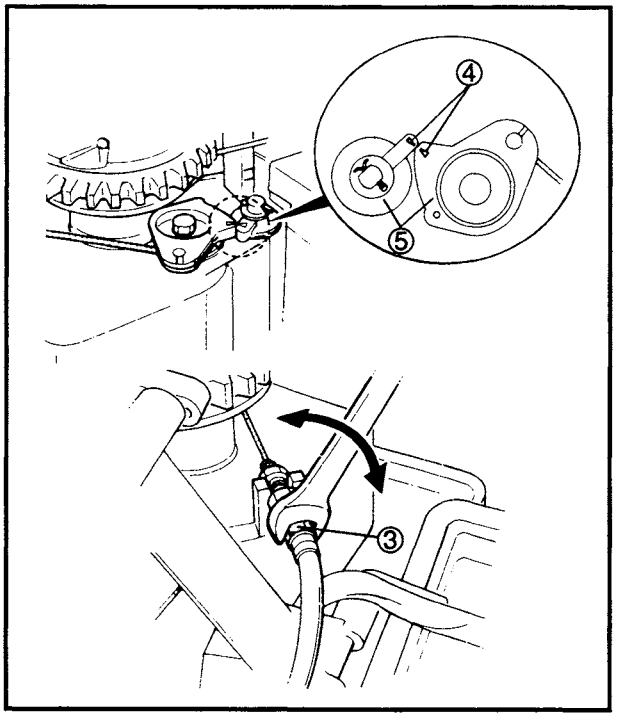
START-IN GEAR PROTECTION ADJUSTMENT

1. Check:
   - Start-in gear protection operation
     Incorrect → Adjust.



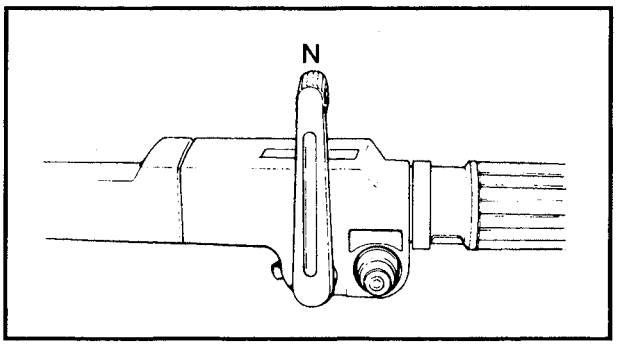
2. Adjust:
   - Start-in gear protection cable length

Adjustment steps:
- Set the shift lever to neutral.
- Remove the hinge pin and throw down the front panel ①.
- Loosen the lock nut ②.
- Adjust the adjuster ③ so that the arrow marks ④ on the lock arms ⑤ align with each other.
- Tighten the lock nut.



NEUTRAL OPENING LIMIT ADJUSTMENT

1. Check:
   - Neutral opening control operation
     Incorrect → Adjust.



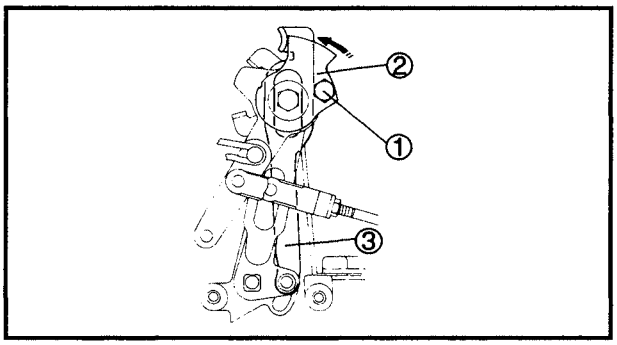
2. Adjust:
   - Accelerator arm position

Adjustment steps:
- Attach the tachometer.

Tachometer:
YU-8036-A/90890-06760

- Set the shift lever to neutral.
- Start the engine.
- Turn the throttle grip so that the engine speed is specified.

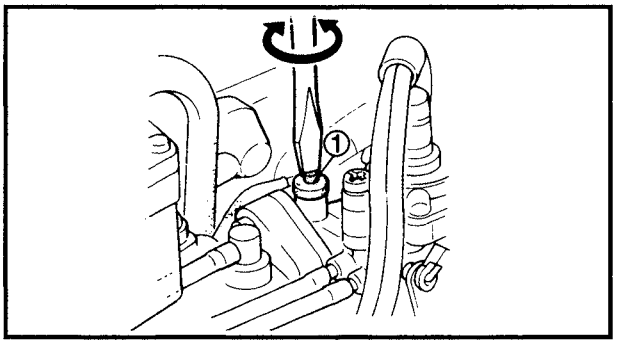
Engine speed:
3,200 ± 50 r/min



- Loosen the bolt ①.
- Contact the accelerator arm ② and shift rod link ③.
- Tighten the bolt.

PILOT SCREW ADJUSTMENT

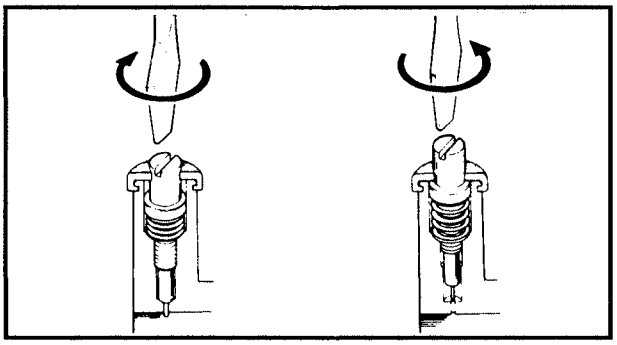
NOTE:
Pilot screw for the USA and Switzerland can not be adjusted.



(Except for USA and Switzerland)

1. Adjust:
   - Pilot screw

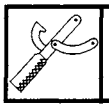
Adjustment steps:
- Screw in the pilot screw ① until it is lightly seated.
- Back out by the specified number of turns.



Pilot screw:
T9.9/FT9.9A
3 ± 1 turns out
F8B, F9.9/F9.9B
3-1/2 ± 1

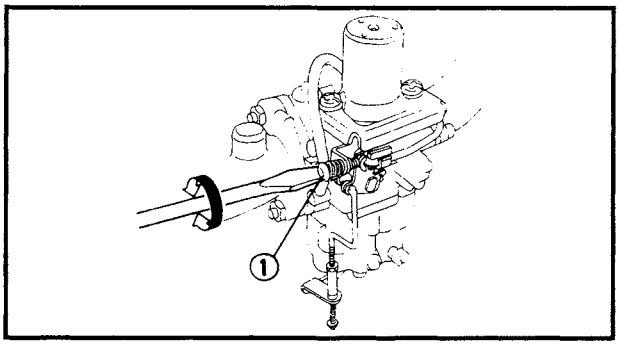
IDLE SPEED ADJUSTMENT

1. Start the engine and let it warm up.
2. Attach:
   - Tachometer
     To spark plug lead.

	**Tachometer:** **YU-8036-A/90890-06760**

3. Measure:
   - Idle speed
     Out of specification → Adjust.

	Idle speed: **T9.9/FT9.9A:** **1,150 ± 50 r/min** **F8B, F9.9/F9.9B:** **950 ± 50 r/min**

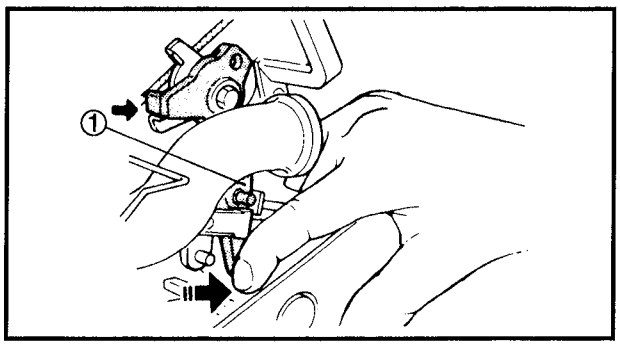


4. Adjust:
   - Idle speed

Adjustment steps: • Turn the throttle stop screw ① in or out until specified idle speed is obtained.
Turning in → Idle speed becomes higher.
Turning out → Idle speed becomes lower.

NOTE:

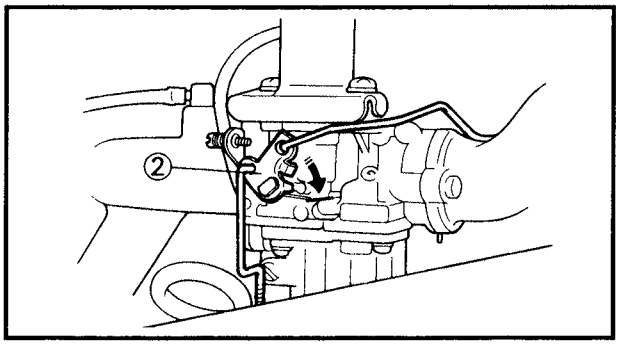
After adjusting the engine idle speed, the throttle link should be adjusted.



THROTTLE LINK ADJUSTMENT

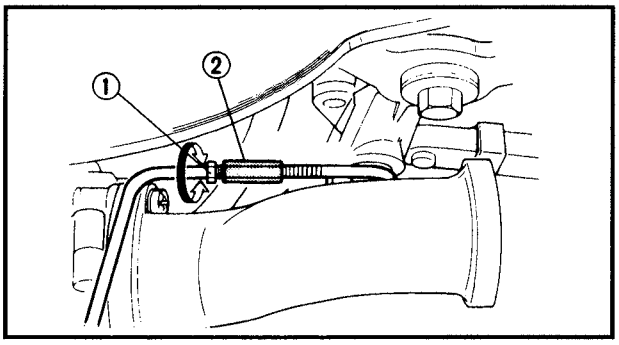
NOTE:

Engine idling speed should be adjusted properly before adjusting the throttle link.



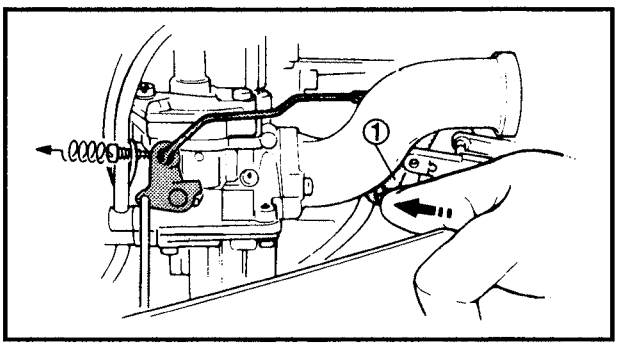
1. Check:
   - Full-open position
     Incorrect → Adjust.

Checking steps:
- Pull the accelerator arm ① to the full-open side.
- Check the throttle lever ② to the full-open position.



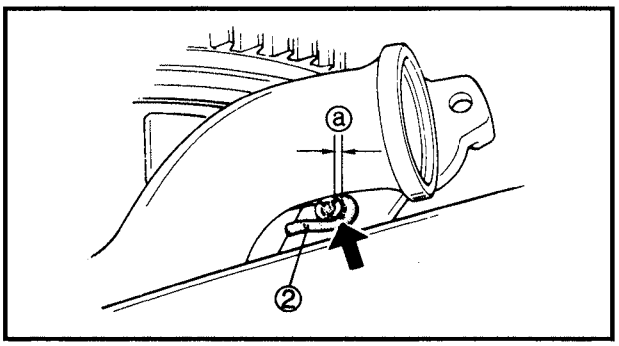
2. Adjust:
   - Throttle link length

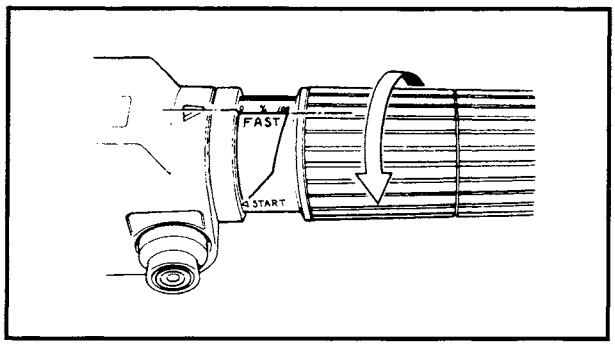
Adjustment steps:
- Loosen the lock nut ①.
- Turn the adjust nut ② in or out until adjustment is suitable.
- Tighten the lock nut.



3. Check:
   - Throttle link free play ⓐ
     No free play → Replace the throttle link.

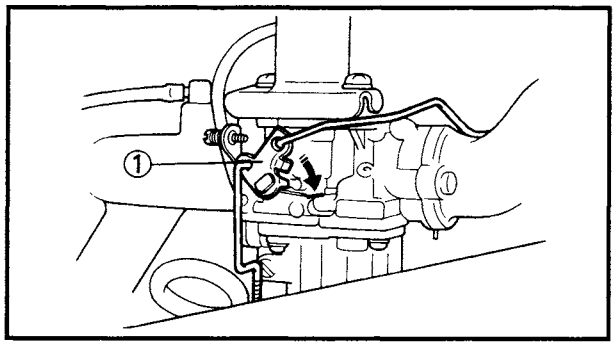
Checking steps:
- Push the accelerator arm ① to the full-closed side.
- Make sure the throttle lever is on the full-closed position.
- Check that the throttle link ② has free play on the throttle lever side.





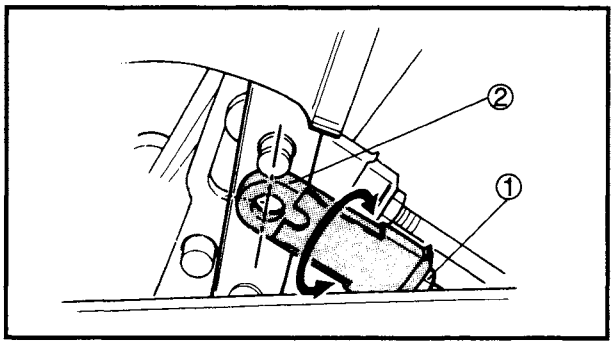
THROTTLE CABLE ADJUSTMENT

NOTE:
Engine idle speed and throttle link should be adjusted properly before adjusting the throttle cable.



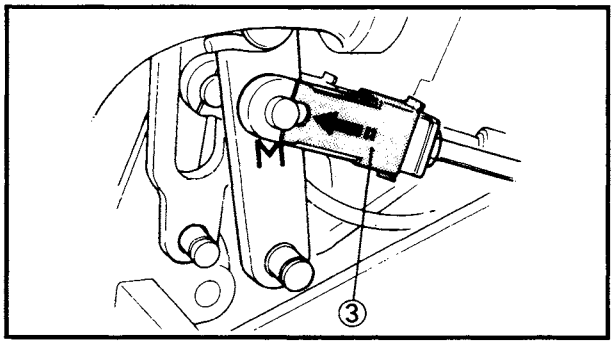
1. Check:
   - Full-open position
     Incorrect → Adjust.

Checking steps:
- Turn the throttle grip to the full-open side.
- Check the throttle lever ① to the full-open position.



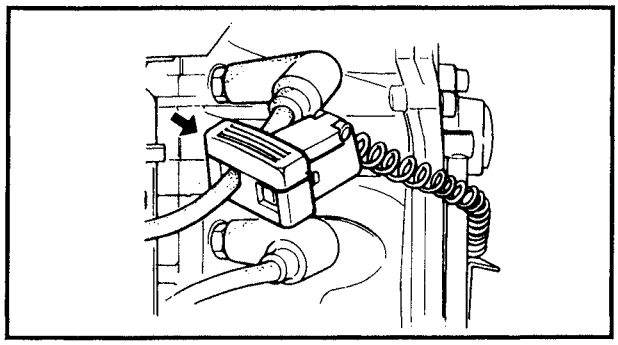
2. Adjust:
   - Throttle cable length

Adjustment steps:
- Loosen the lock nut ①.
- Remove the cable end ②.
- Pull the accelerator arm to the full-open side.
- Turn the cable end in or out until adjustment is suitable.
- Fit the cable end to the pin marked with "M" on the accelerator arm.
- Push the cable end stopper ③ to secure the cable end.
- Tighten the lock nut.



IGNITION TIMING CHECK

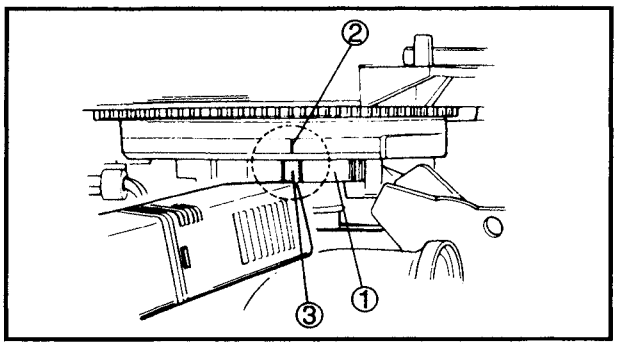
NOTE:
Ignition timing is advanced by the CDI unit automatically. Therefore only the checking procedure is shown in this section.



1. Attach:
   - Tachometer
   - Timing light

   To spark plug lead for #1 cylinder.

Tachometer:
YU-8036-A/90890-06760
Timing light:
YU-33277-A/90890-03141



2. Check:
   - Ignition timing

   Incorrect firing range → Check flywheel and/or pickup assembly.

Checking steps:
- Warm up the engine and set it at the specified speed.

Engine speed:
T9.9/FT9.9A: 1,150 ± 50 r/min
F8B, F9.9/F9.9B: 950 ± 50 r/min

- Direct the timing light toward the flywheel magneto base ①.
- Visually check the stationary pointer ② to verify it is within the required firing range ③ indicated on the flywheel.

CHAPTER 4
FUEL SYSTEM

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FUEL PUMP 4-3
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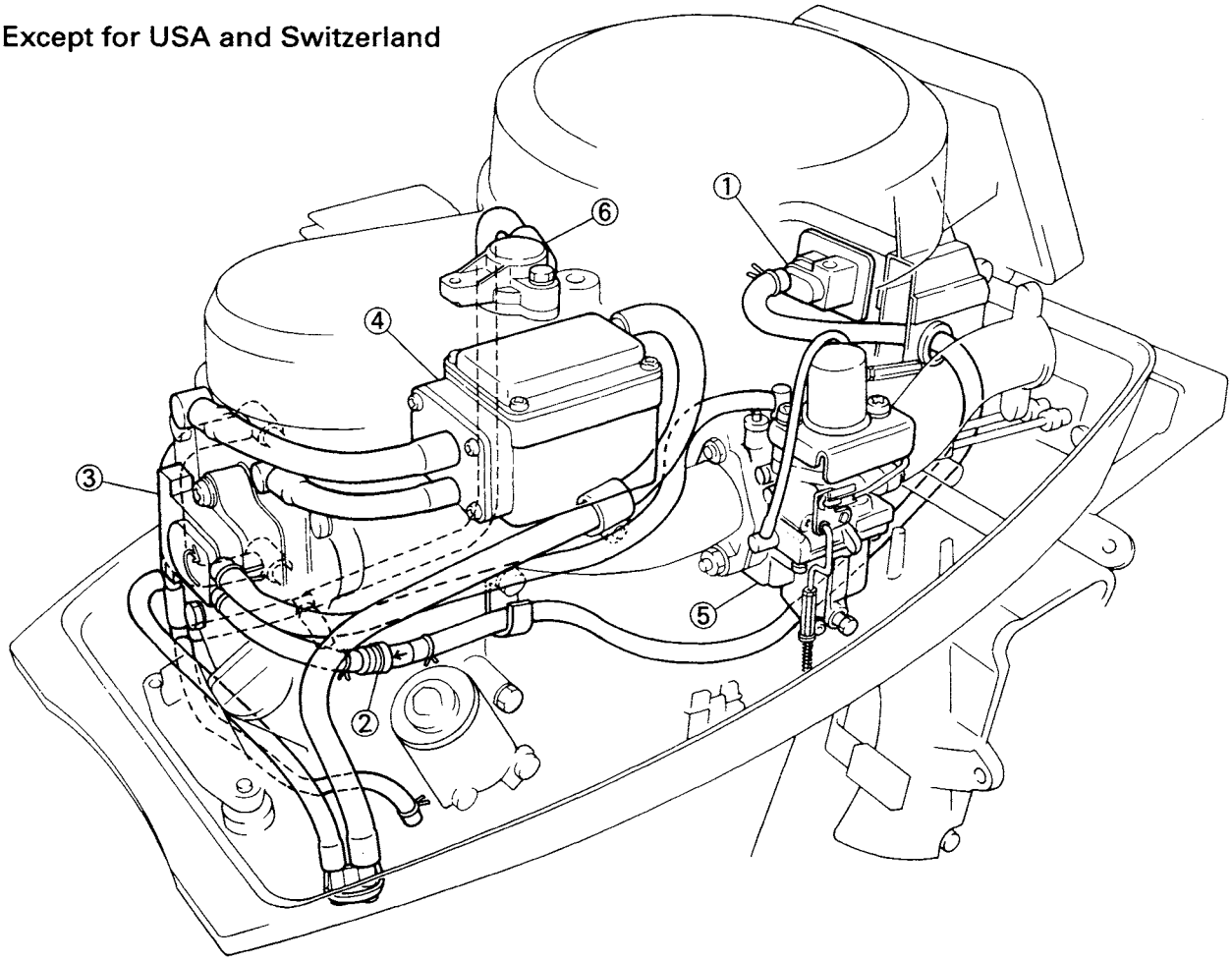
E20050-0

FUEL SYSTEM

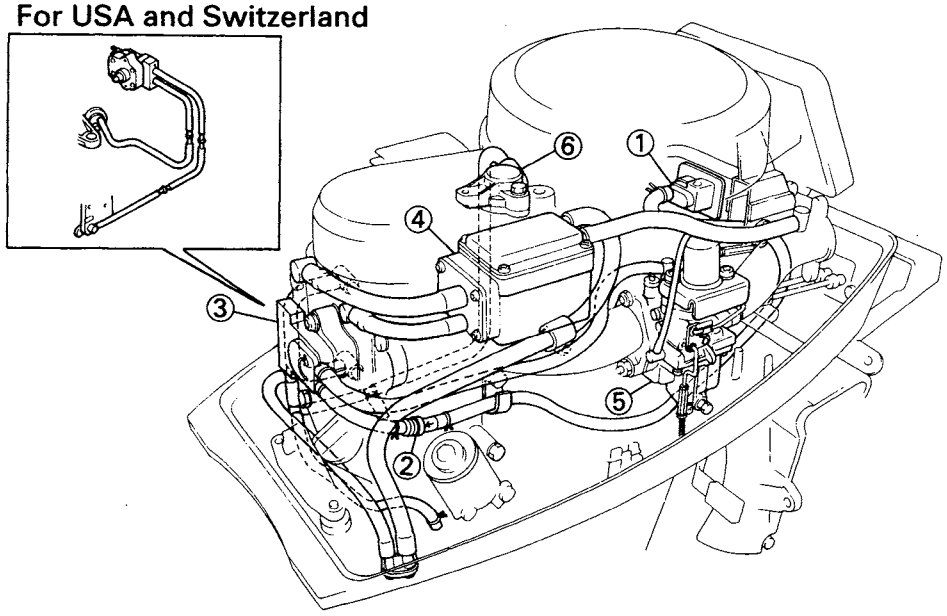
FUEL LINE LAYOUT

Check that the fuel line is correctly installed.

Except for USA and Switzerland



For USA and Switzerland



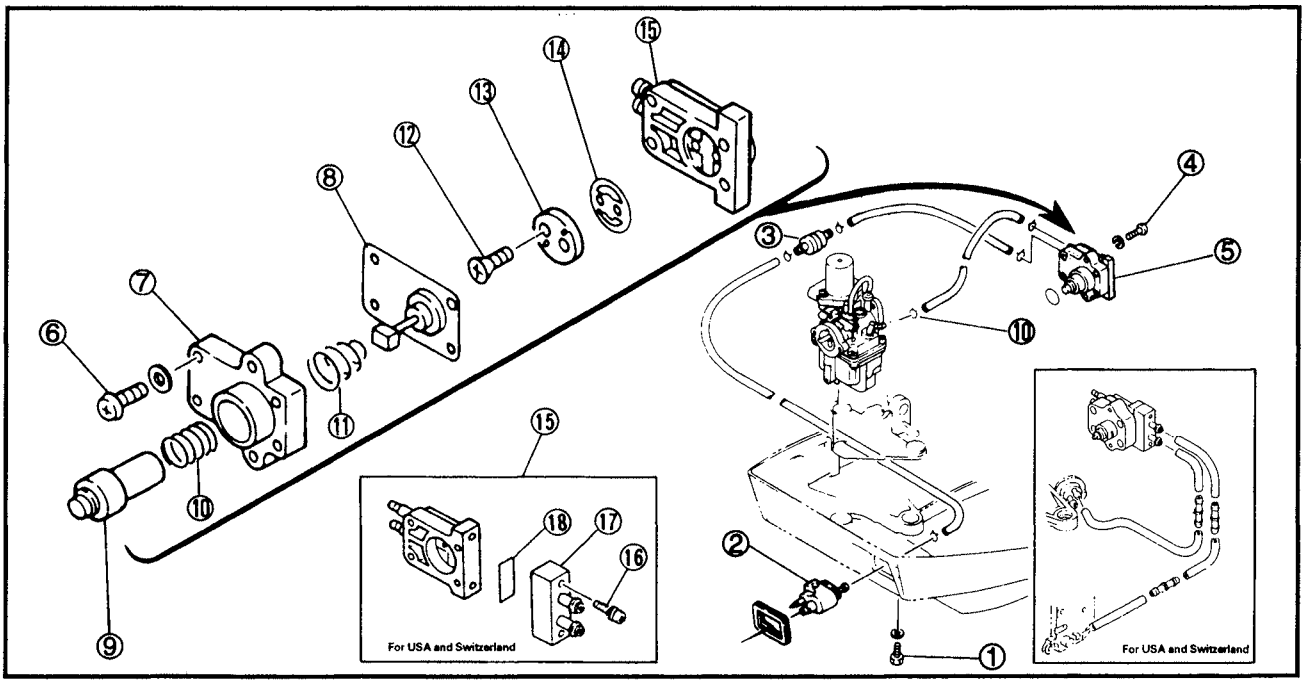
① Fuel join
② Fuel strainer
③ Fuel pump
④ Oil separator
⑤ Carburetor
⑥ Thermostat cover

PREPARATION FOR REMOVAL

* Remove the top cowling.

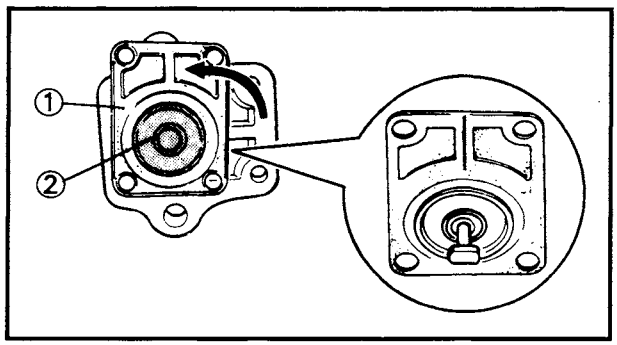
⚠ WARNING

- **Gasoline (petrol) is highly flammable and explosive. Handle with special care.**
- **Failure to check for fuel leakage may result in fire or explosion.**



Extent of removal: ① Fuel joint removal ② Fuel pump removal ③ Fuel pump disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
①	1	Bolt	1	
	2	Fuel joint	1	Disconnect the hose.
	3	Fuel strainer	1	Disconnect the hose.
②	4	Screw	2	
	5	Fuel pump	1	Disconnect the hose.
③	6	Screw	4	
	7	Pump body	1	
	8	Diaphragm	1	
	9	Plunger	1	
	10	Spring	1	
	11	Diaphragm spring	1	
	12	Screw	2	
	13	Plate	1	
	14	Check valve	1	
	15	Pump cover	1	
	16	Screw	2	(For USA and Switzerland)
	17	Cover	1	(For USA and Switzerland)
	18	Seal	1	(For USA and Switzerland)



E21650-1

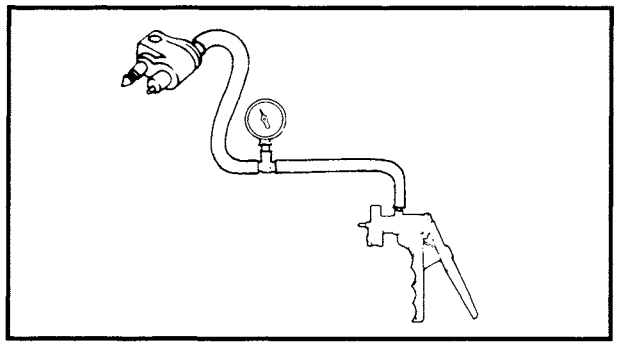
REMOVAL POINTS

DIAPHRAGM

1. Remove:
   - Diaphragm ①

CAUTION:

Push the plunger, hold the plate ②, and turn the diaphragm 90°.



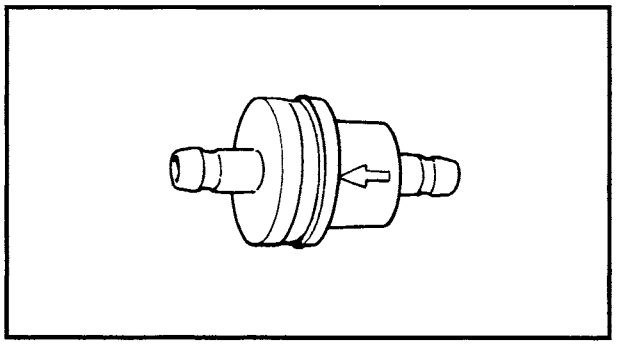
E21850-0

INSPECTION

FUEL JOINT

1. Measure:
   - Fuel joint operation
     Impossible to maintain the specified pressure for 10 sec. → Replace.

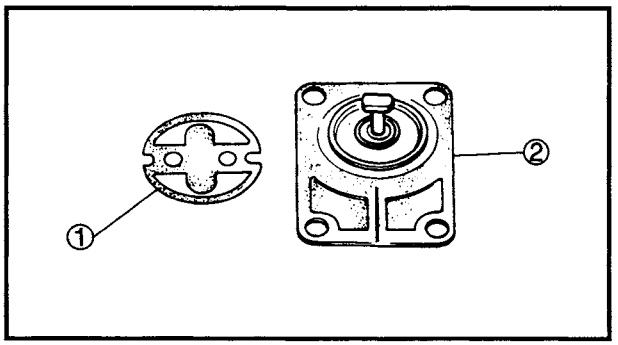
Measuring steps: • Attach the Mity Vac.	
	Mity Vac: **YB-35956/90890-06756**
• Apply the specified pressure.	
	Specified pressure: **50 kPa (0.5 kg/cm², 7.1 psi)**



E21852-0

FUEL STRAINER

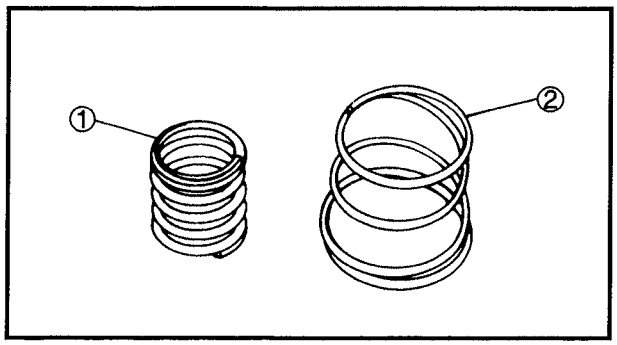
1. Inspect:
   - Fuel strainer
     Crack/Leak/Clog → Replace.



E21854-0

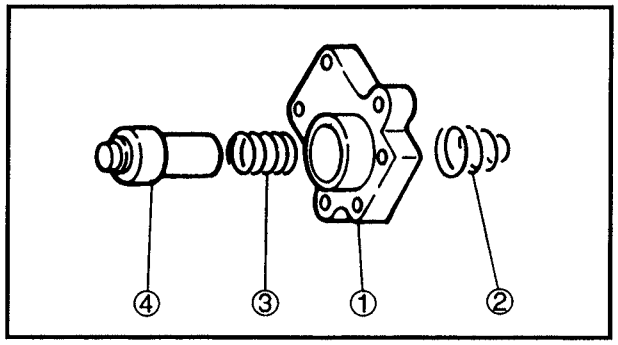
FUEL PUMP

1. Inspect:
   - Check valve ①
   - Diaphragm ②
     Damage → Replace.



2. Inspect:
   - Spring ①
   - Diaphragm spring ②

   Damage → Replace.

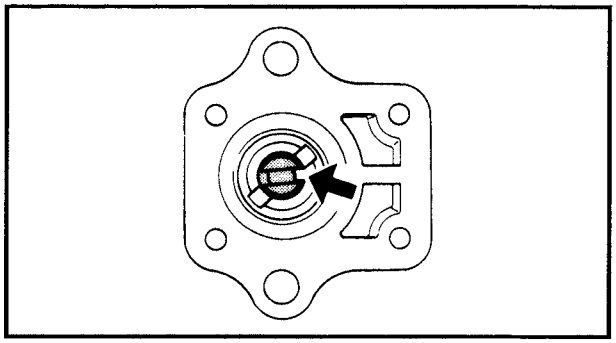


E22050-0

ASSEMBLY AND INSTALLATION

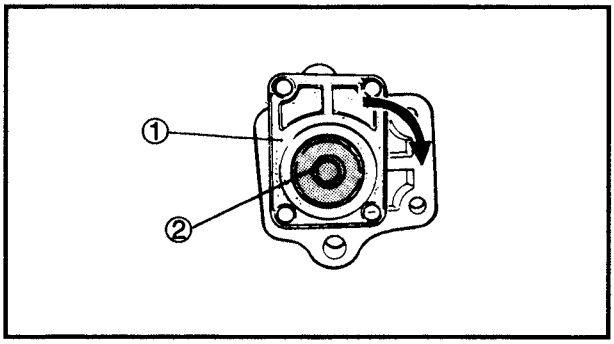
FUEL PUMP

1. Install:
   - Pump body ①
   - Diaphragm spring ②
   - Spring ③
   - Plunger ④



NOTE:

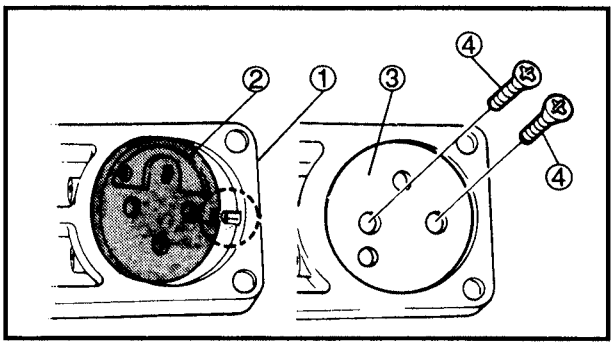
Align the recess in the plunger with the pump body.



2. Install:
   - Diaphragm ①

CAUTION:

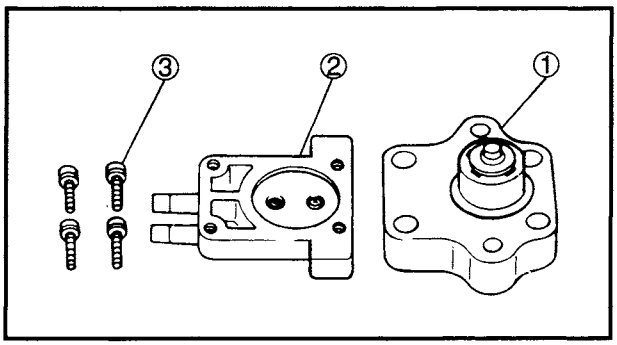
Push the plunger, hold the plate ②, and turn the diaphragm 90°.



3. Install:
   - Pump cover ①
   - Check valve ②
   - Plate ③
   - Screw ④

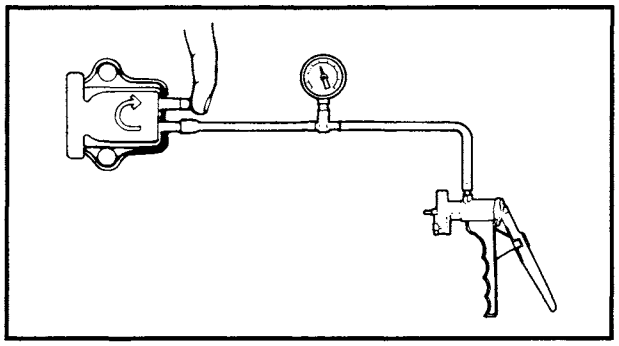
NOTE:

Align the recess in the check valve and plate with the projection of the pump cover.



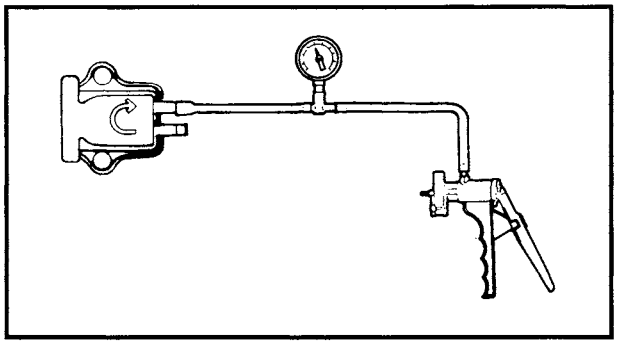
4. Install:
   - Pump body ①
   - Pump cover ②
   - Screw ③

NOTE:
After installing, check the smooth movement of the plunger.



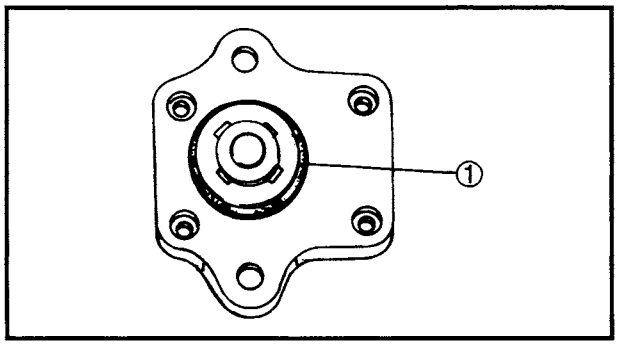
5. Measure:
   - Fuel pump operation
     Impossible to maintain the specified pressure for 10 sec. → Replace.

Measuring steps:
• Attach the Mity Vac to the inlet of the fuel pump.
Mity Vac: **YB-35956/90890-06756**
• Cover the outlet of the fuel pump. • Apply the specified pressure.
Specified pressure: **50 kPa (0.5 kg/cm², 7.1 psi)**



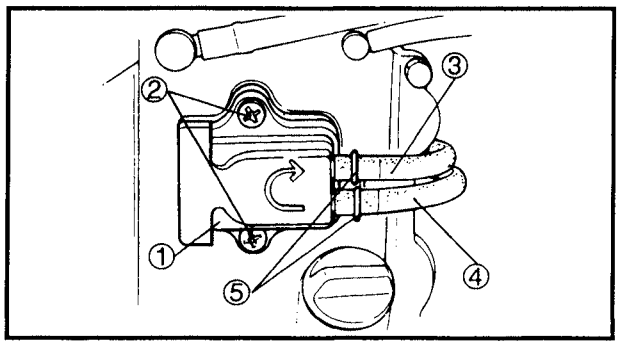
6. Measure:
   - Fuel pump operation
     Impossible to maintain the specified pressure for 10 sec. → Replace.

Measuring steps:
• Attach the Mity Vac to the outlet.
Mity Vac: **YB-35956/90890-06756**
• Apply the specified pressure.
Specified pressure: **50 kPa (0.5 kg/cm², 7.1 psi)**

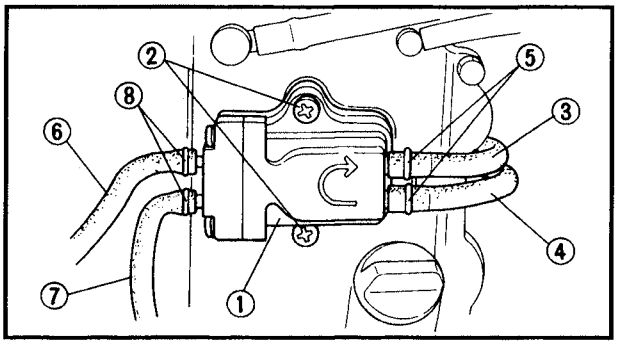


7. Install:
   - O-ring ①

NOTE:
Always use a new O-ring.



8. Install:
(Except for USA and Switzerland)
- Fuel pump ①
- Screw ②
- Hose ③
- Hose ④
- Clamp ⑤



9. Install:
(For USA and Switzerland)
- Fuel pump ①
- Screw ②
- Hose ③
- Hose ④
- Clamp ⑤
- Hose ⑥
- Hose ⑦
- Clamp ⑧

E31050-0

CARBURETOR

NOTE:

Pilot screw for USA and Switzerland can not be removed and adjusted.

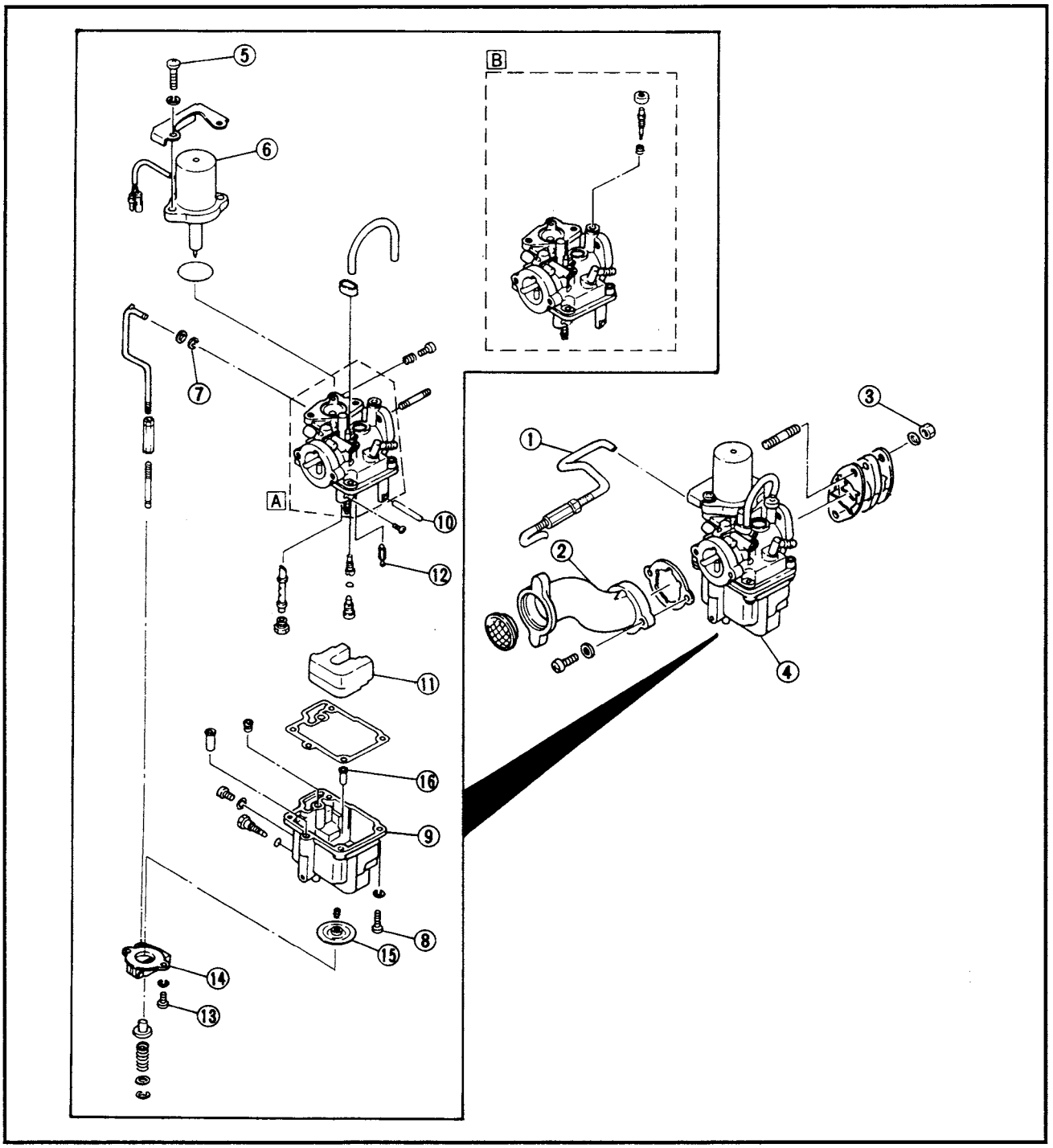
PREPARATION FOR REMOVAL

* Remove the top cowling.
* Disconnect the wire lead.

⚠ WARNING

- **Gasoline (petrol) is highly flammable and explosive. Handle with special care.**
- **Failure to check for fuel leakage may result in fire or explosion.**

[A] For USA and Switzerland
[B] Except for USA and Switzerland



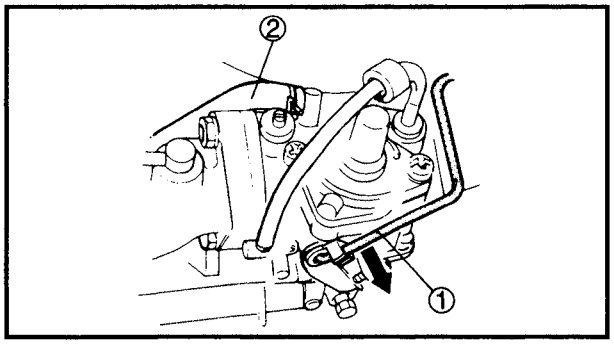
E31150-0

NOTE ON REMOVAL AND REASSEMBLY

- With the engine mounted, the following parts can be removed.
- Before inspection, the removed parts should be cleaned and blow out all passages and jets with compressed air.
- After removing the carburetor, cover the carburetor joint preventing foreign material from entering.

Extent of removal: ① Carburetor removal ② Electrothermal valve removal ③ Carburetor disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
① ② ③	1	Throttle link	1	Disconnect the link lod.
	2	Funnel	1	
	3	Nut	2	
	4	Carburetor	1	
	5	Screw	2	
	6	Electrothermal valve	1	
	7	Clip	1	
	8	Screw	4	
	9	Float chamber	1	
	10	Pin	1	
	11	Float	1	
	12	Needle valve	1	
	13	Screw	2	
	14	Cover	1	
	15	Diaphragm	1	
	16	Filter	1	

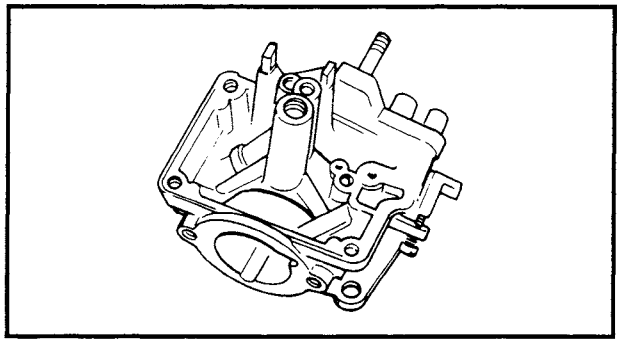


E31250-0

REMOVAL POINTS

JOINT

1. Disconnect:
   - Throttle link ①
   - Fuel hose ②



E32050-0

INSPECTION

CARBURETOR BODY

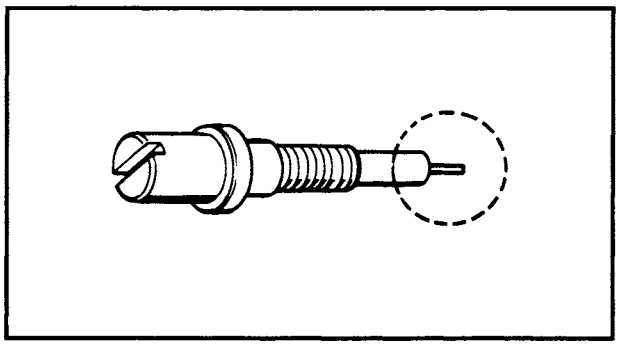
1. Inspect:
   - Carburetor body
     Crack/Damage → Replace.
     Contamination → Clean.

⚠ WARNING

Protect your eyes with suitable safety spectacles or safety goggles when using compressed air.

NOTE:

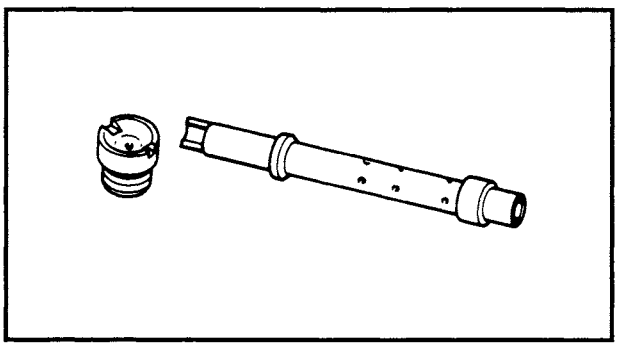
- Use a petroleum based solvent for cleaning. Blow out all passages with compressed air.
- Never use a wire.



E32052-0

PILOT SCREW
(Except for USA and Switzerland)

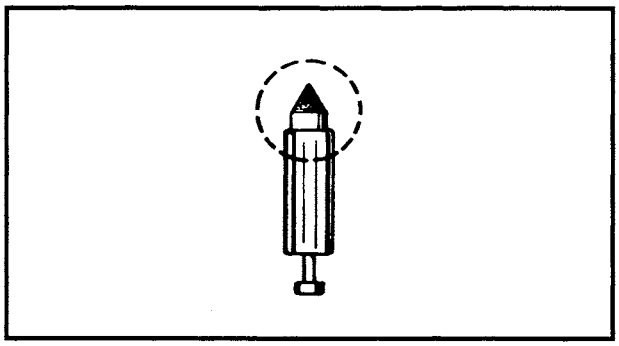
1. Inspect:
   - Pilot screw
     Bend/Wear → Replace.



E32054-0

JET AND NOZZLE

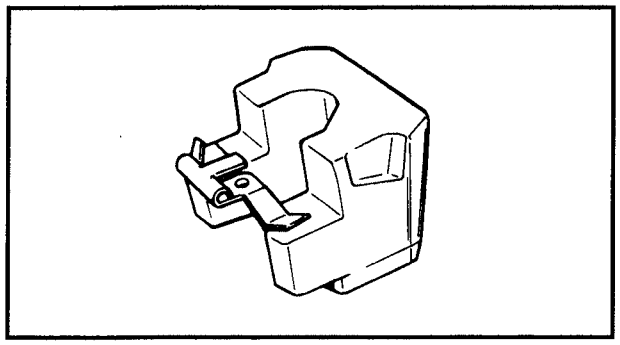
1. Inspect:
   - Main jet
   - Pilot jet
   - Check valve
   - Main nozzle
     Contamination → Replace.



E32056-0

NEEDLE VALVE

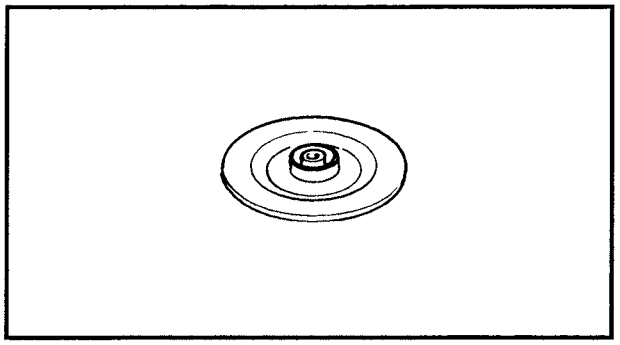
1. Inspect:
   - Needle valve
     Grooved wear → Replace.



E32058-0

FLOAT

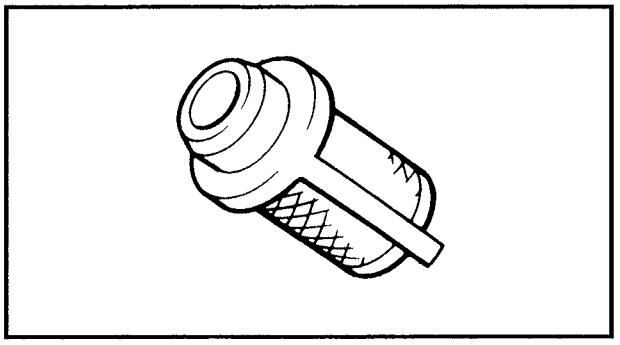
1. Inspect:
   - Float
     Crack/Damage → Replace.



E32150-0

DIAPHRAGM

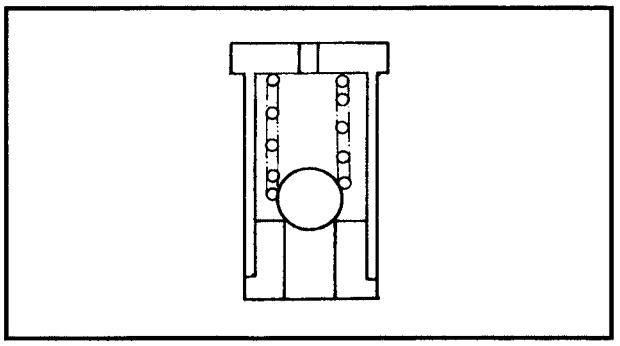
1. Inspect:
   - Diaphragm
     Damage → Replace.



E32152-0

FILTER

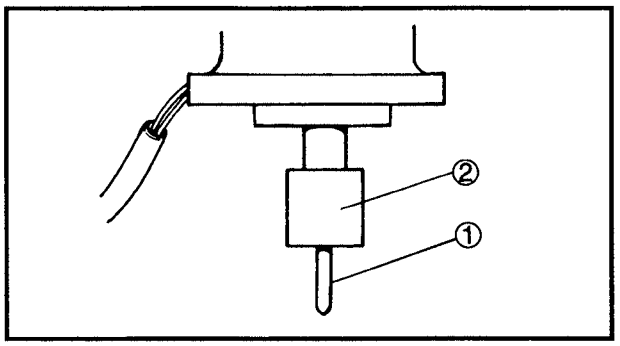
1. Inspect:
   - Filter
     Contamination → Clean.
     Damage → Replace.



E32154-0

CHECK VALVE

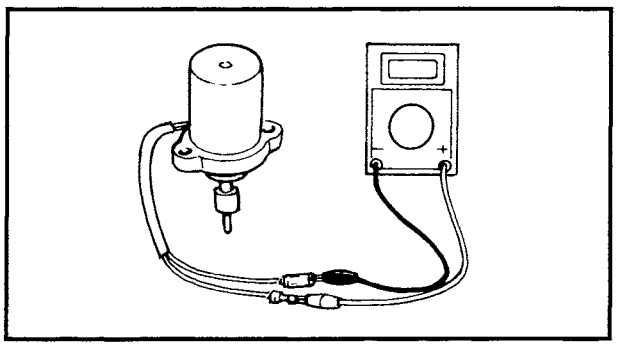
1. Inspect:
   - Check valve
     Damage → Replace.



E32156-0

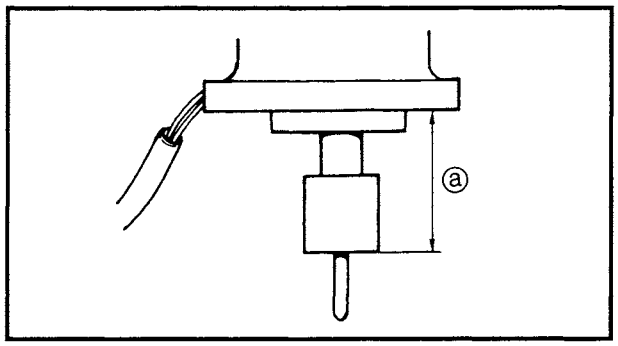
ELECTROTHERMAL VALVE

1. Inspect:
   - Needle valve ①
   - Piston valve ②
     Wear/Damage → Replace.



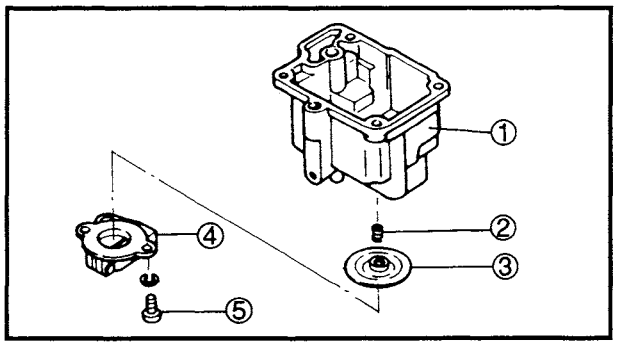
2. Measure:
   - Electrothermal valve resistance
     Out of specification → Replace.

Electrothermal valve resistance:
Black – Black
4.8 ~ 7.2 Ω at 20°C (68°F)



3. Check:
   - Piston valve height ⓐ
     No change → Replace.

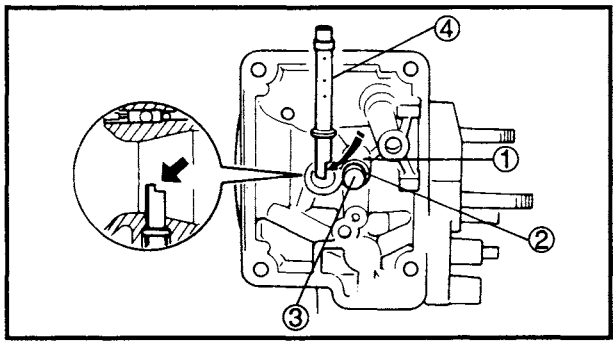
Checking steps:
- Connect the 12 V battery.
- Wait for several minutes.
- Check the piston height.



E34050-0

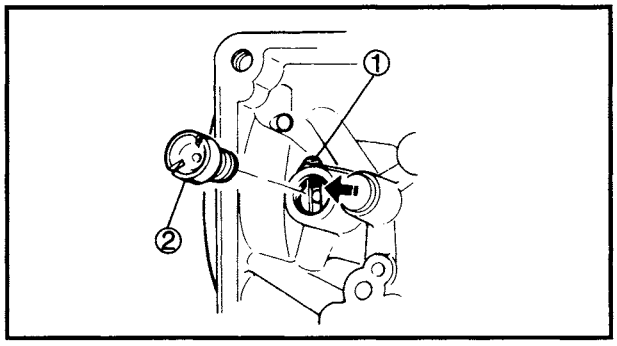
ASSEMBLY AND INSTALLATION

1. Install:
   - Float chamber ①
   - Spring ②
   - Diaphragm ③
   - Cover ④
   - Screw ⑤



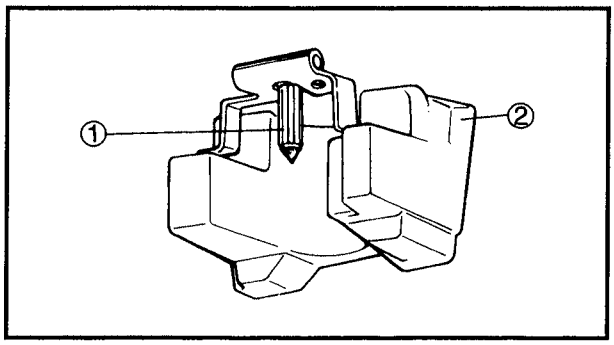
2. Install:
   - Pilot jet ①
   - O-ring ②
   - Seal cap ③
   - Main nozzle ④

NOTE:
Position the nozzle so that the cutaway of the nozzle faces the intake manifold.



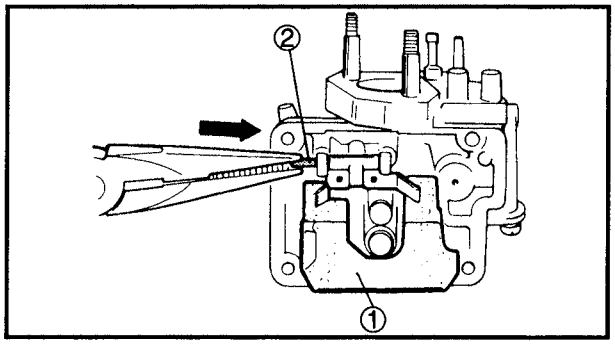
3. Install:
   - Screw ①
   - Main jet ②

NOTE:
Align the slit in the main nozzle with the screw hole in the carburetor.



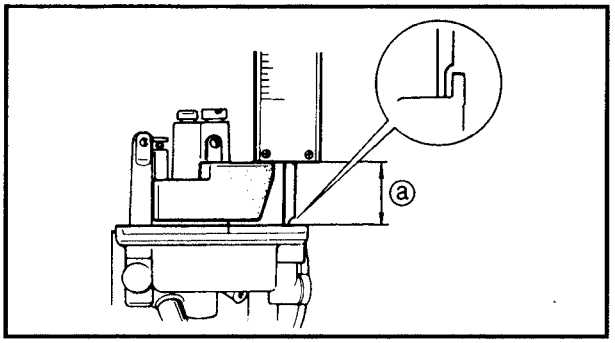
4. Install:
   - Needle valve ①
   - Float ②

NOTE:
Install the valve into the float hinge.



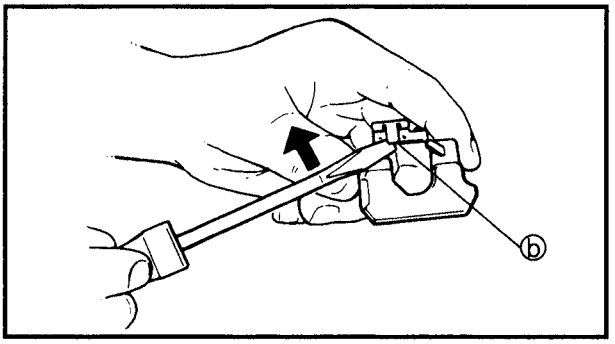
5. Install:
   - Float ①
   - Pin ②

NOTE:
After installing, check the smooth movement of the float.

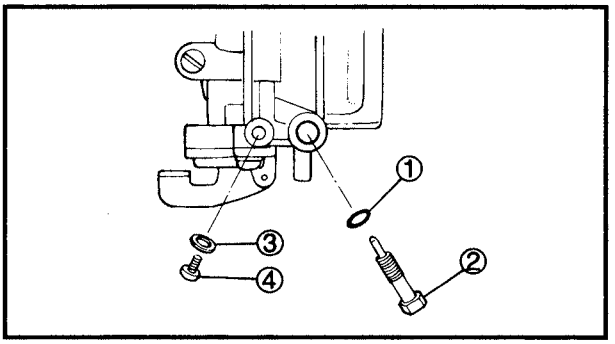


6. Measure:
   - Float height ⓐ
     Out of specification → Fold the tab ⓑ to adjust float arm height.

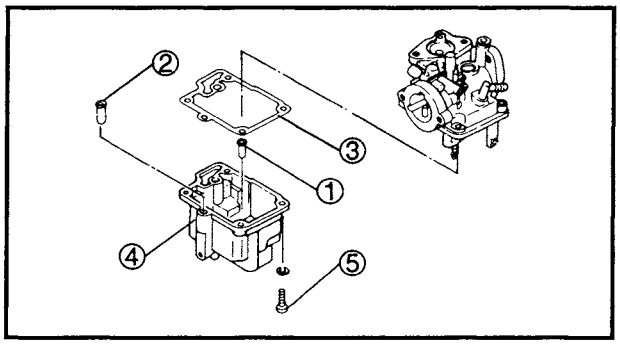
	Float height: **25.5 ± 1 mm (1.00 ± 0.04 in)**



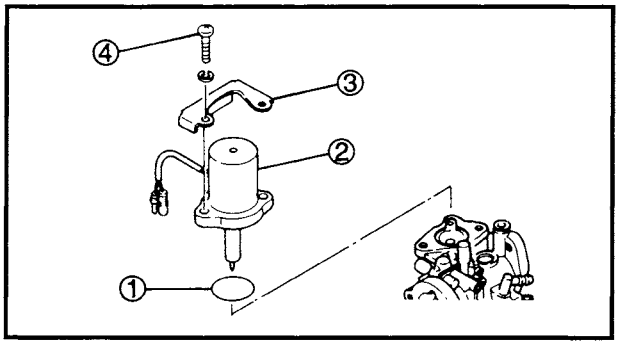
NOTE:
The float should be resting on the needle valve, but not compressing the needle valve.



7. Install:
   - O-ring ①
   - Drain screw ②
   - Gasket ③
   - Drain screw ④

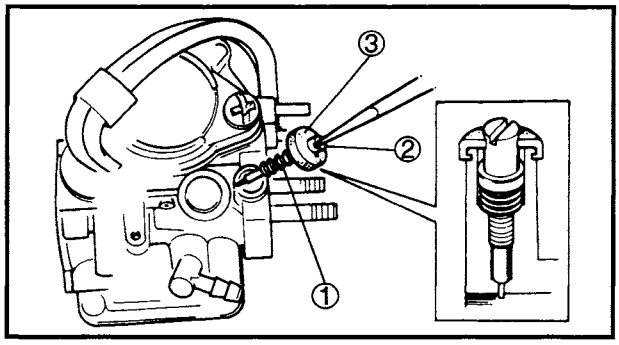


8. Install:
   - Filter ①
   - Check valve ②
   - Gasket ③
   - Float chamber ④
   - Screw ⑤



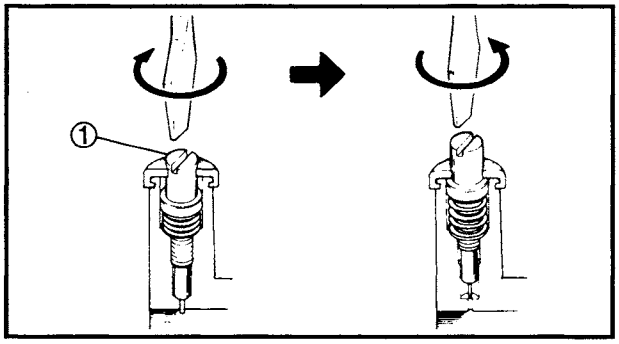
9. Install:
   - O-ring ①
   - Electrothermal valve ②
   - Plate ③
   - Screw ④
10. Install:
    (Except for USA and Switzerland)
    - Spring ①
    - Pilot screw ②
    - Seal cap ③

NOTE:
After placing the seal cap on the pilot screw, fit it to the groove in the carburetor.

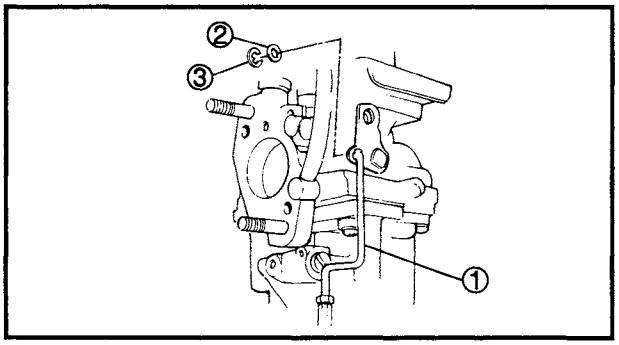


11. Adjust:
    (Except for USA and Switzerland)
    - Pilot screw ①

Adjustment steps:
- Screw in the pilot screw until it is lightly seated.
- Back out by the specified number of turns.

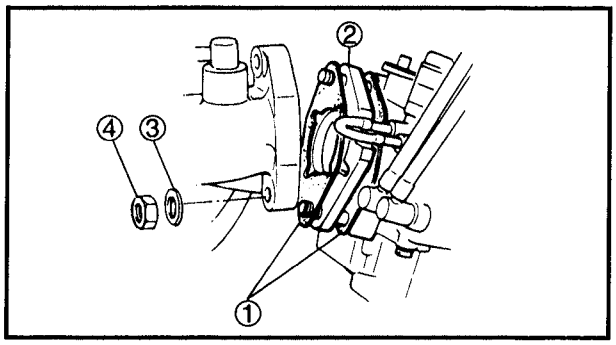


Pilot screw (Except for USA and Switzerland):
T9.9/FT9.9A: 3 ± 1 turns out
F8B, F9.9/F9.9B:
3-1/2 ± 1 turns out

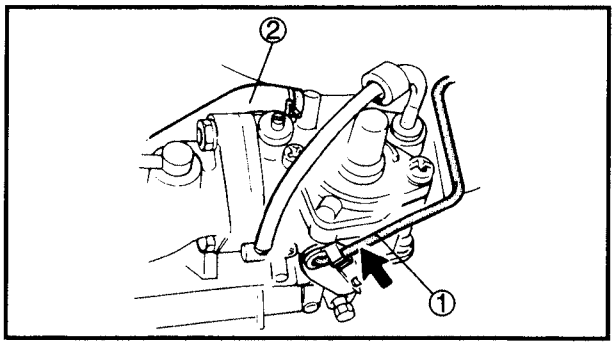


12. Install:
    - Rod ①
    - Washer ②
    - Clip ③

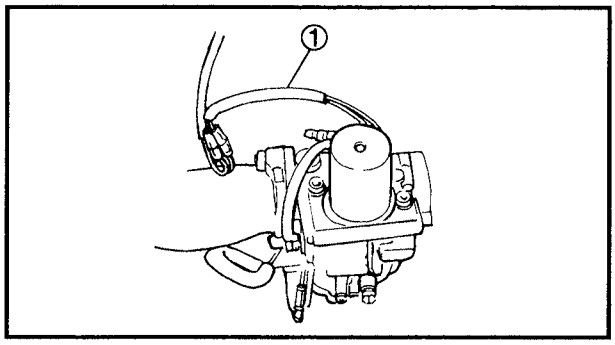
NOTE:
Always use a new clip.



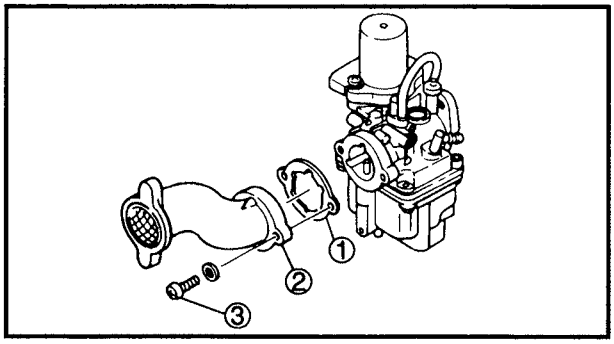
13. Install:
- Gasket ①
- Spacer ②
- Washer ③
- Nut ④



14. Connect:
- Throttle link ①
- Fuel hose ②



15. Connect:
- Wire lead ①



16. Install:
- Gasket ①
- Funnel ②
- Screw ③

17. Adjust:
- Idle speed
  Refer to page 3-13.

CHAPTER 5
POWER UNIT

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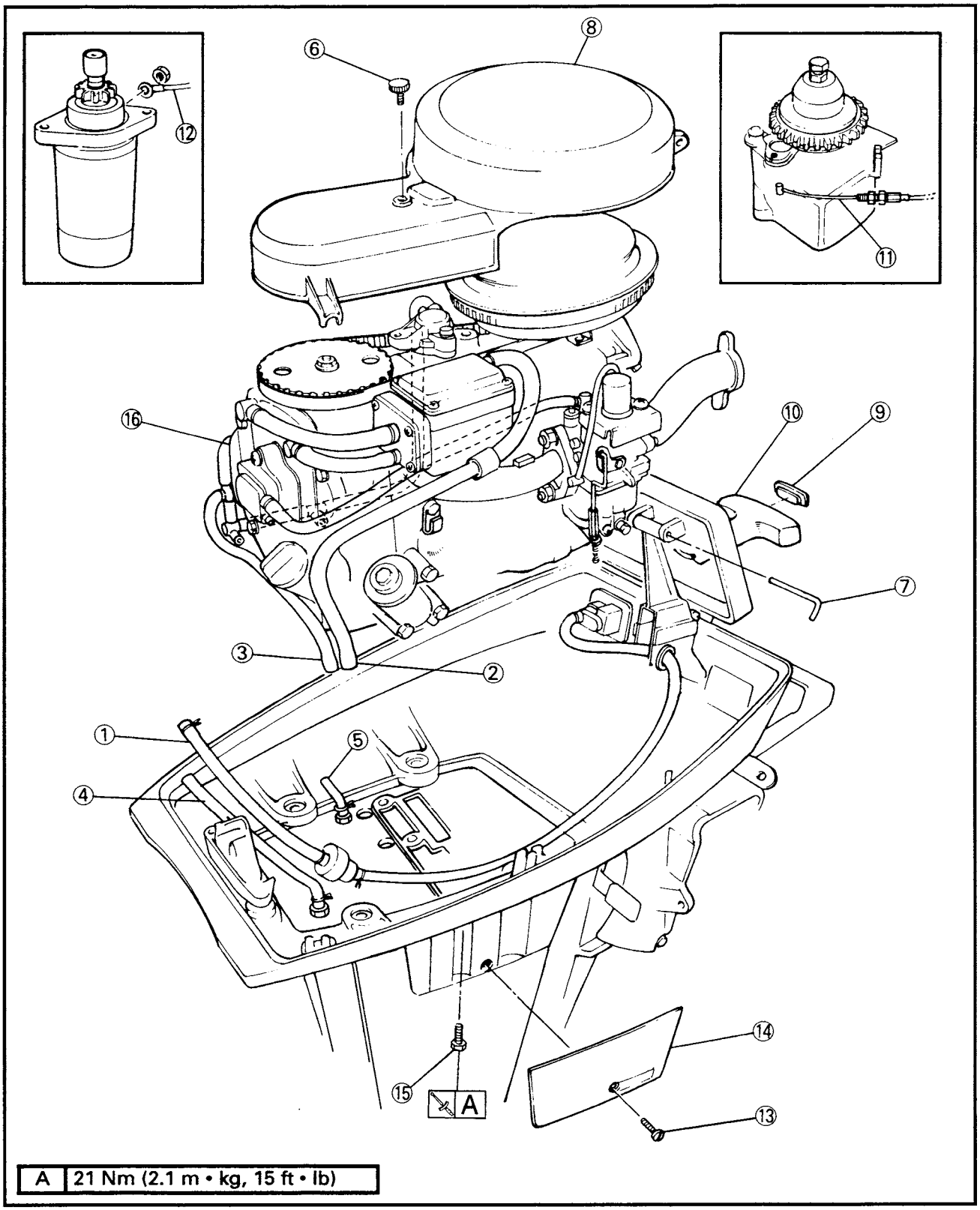
POWER UNIT REMOVAL

PREPARATION FOR REMOVAL

* Drain the engine oil.
* Remove the top cowling.
* Remove the terminal cover.
* Disconnect the oil lamp lead.
* Remove the oil level gauge.
* Disconnect the stop switch leads.



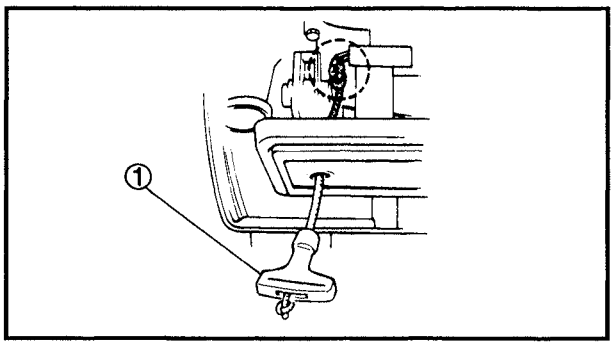
A	21 Nm (2.1 m • kg, 15 ft • lb)

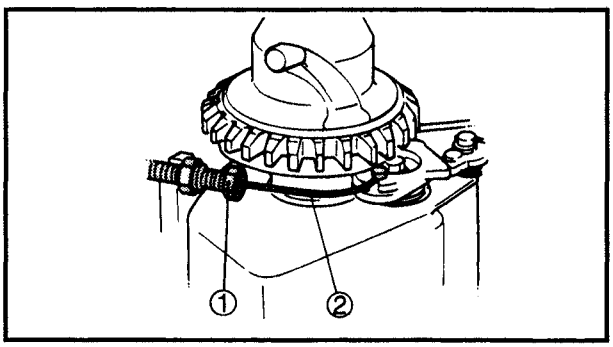
NOTE ON REMOVAL AND REASSEMBLY

- After removing the power unit, protect the lubricating system, including the oil pan and relief valve, from dust and dirt.

Extent of removal: ① Power unit removal

Extent of removal	Order	Part name	Q'ty	Remarks
①	1	Fuel hose	1	
	2	Blow by hose	1	
	3	Water hose	1	
	4	Water hose	1	
	5	Water hose	1	
	6	Screw	1	
	7	Hinge pin	1	
	8	Flywheel cover	1	
	9	Grip cover	1	Recoil starter model only
	10	Starter grip	1	Refer to "REMOVAL POINTS".
	11	Neutral starting device cable	1	
	12	Battery lead	1	Electric starter model only
	13	Screw	2	
	14	Apron	2	
	15	Bolt	6	
	16	Power unit	1	





REMOVAL POINTS

STARTER GRIP

1. Remove:
   - Starter grip ①

NOTE:

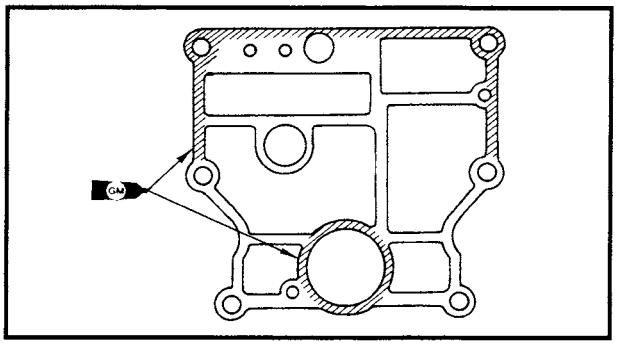
When removing the starter grip, pull out the starter rope and make a knot in the rope so that the rope is not pulled into the starter.

STOP WIRE

1. Remove:
   - Lock nut ①
   - Start-in gear protection cable ②

NOTE:

Do not remove the stop wire before removing the starter grip, or it is impossible to pull out the starter rope when removing it.



INSTALLATION

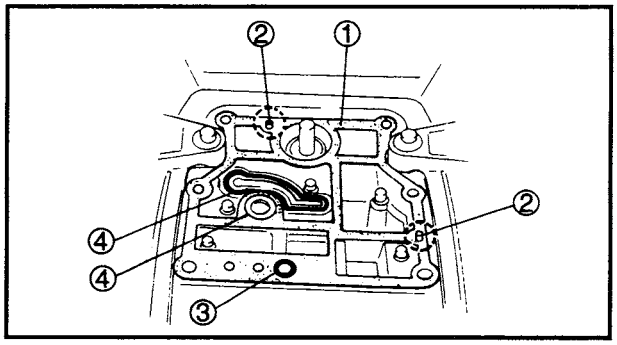
POWER UNIT

1. Apply:
   - Gasket Maker

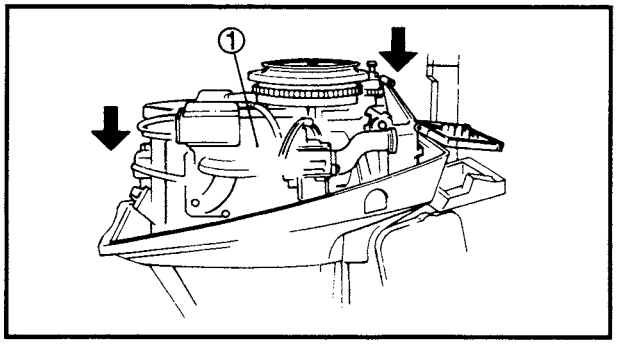
   Onto both faces of the gasket.

NOTE:

Clean the contacting surface of crankcase.



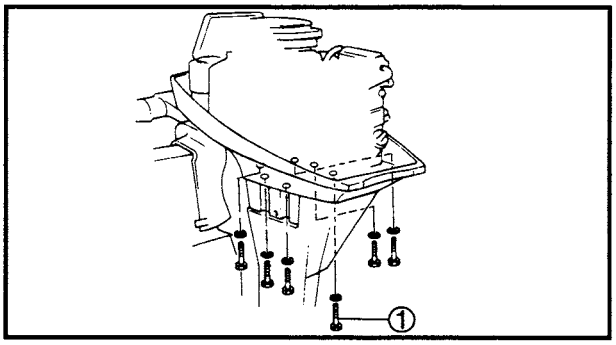
2. Install:
   - Gasket ①
   - Dowel pin ②
   - O-ring ③
   - Seal ④



3. Install:
   - Power unit ①

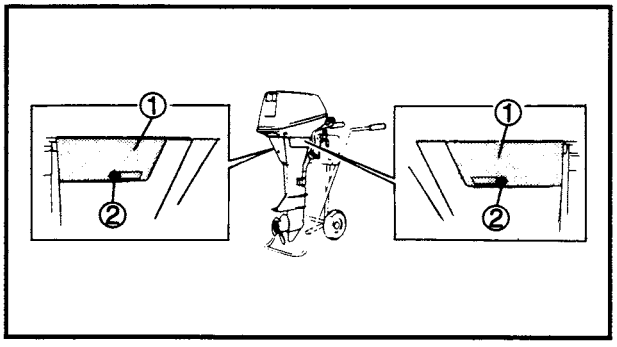
NOTE:

- If the crankshaft splines do not mesh with the drive shaft splines, turn the flywheel a little so that they can mesh.
- Use care not to pinch the lead and pipe.

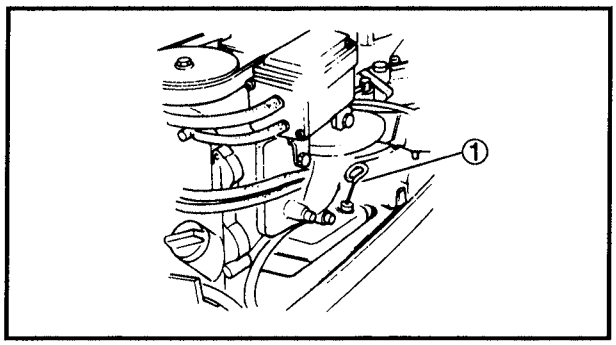


4. Install:
   - Bolt ①

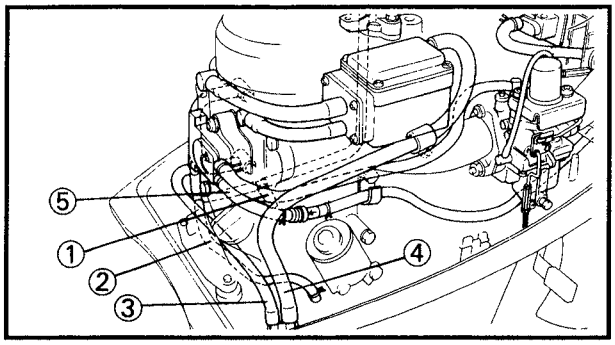
	Bolt: **21 Nm (2.1 m • kg, 15 ft • lb)**



5. Install:
   - Apron ①
   - Screw ②

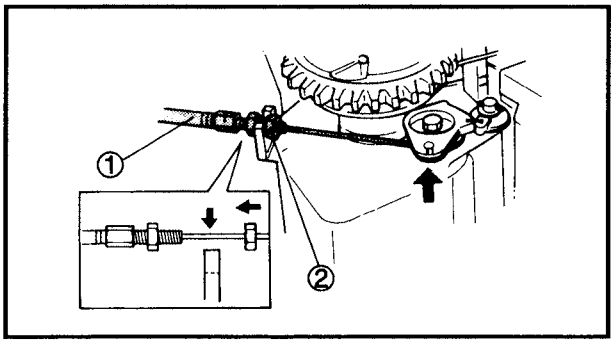


6. Install:
   - Oil level gauge ①

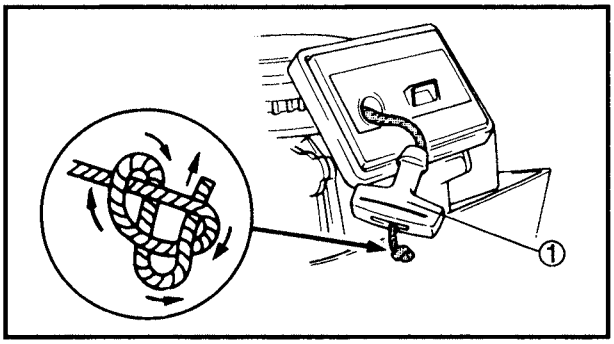


7. Connect:
   - Water hose ①
   - Water hose ②
   - Water hose ③
   - Blow by hose ④
   - Fuel hose ⑤

RECOIL STARTER



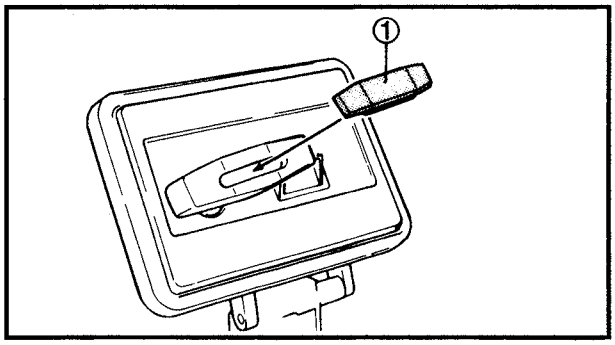
1. Install:
   - Start-in gear protection wire ①
   - Lock nut ②
2. Adjust:
   - Start-in gear protection cable length
     Refer to page 3-11.



3. Install:
   - Starter grip ①

NOTE:

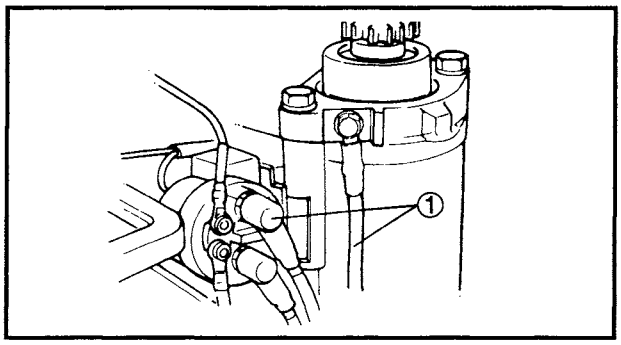
Pass the starter rope through the front panel and starter grip, and make a knot in the end of the rope, then put it into the starter grip.



4. Install:
   - Grip cover ①

NOTE:

After installing the grip cover, untie the knot, and let the rope wind around the starter.



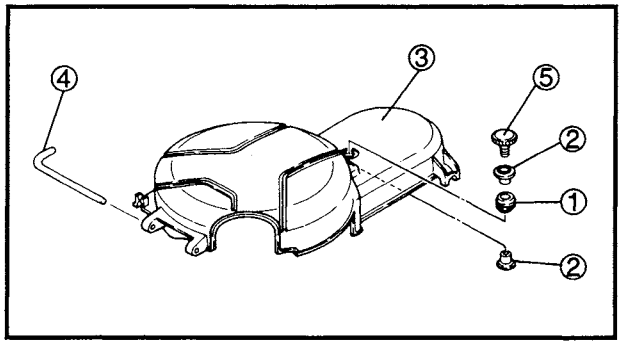
BATTERY LEAD

1. Install:
   - Battery lead ①

   Refer to pages 8-2 ~ 8-4.

NOTE:

Connect the battery lead to both of the starter motor and starter relay.



FLYWHEEL COVER

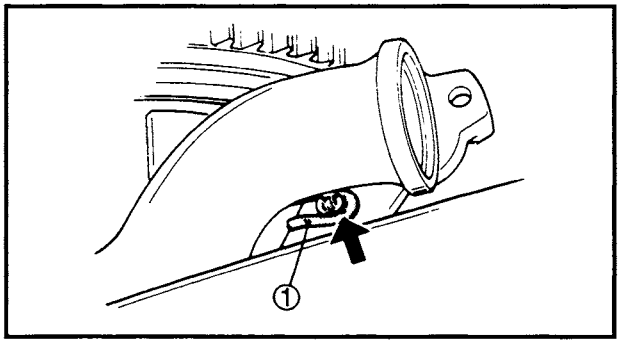
1. Install:
   - Grommet ①
   - Collar ②
   - Flywheel cover ③
   - Hinge pin ④
   - Screw ⑤

NOTE:

Secure the L-shaped portion to the holder.

2. Install:
   - Electrical leads
   - Terminal cover
   - Screw

   Refer to pages 8-1 ~ 8-4.



3. Connect:
   - Throttle link ①
4. Adjust:
   - Throttle link length

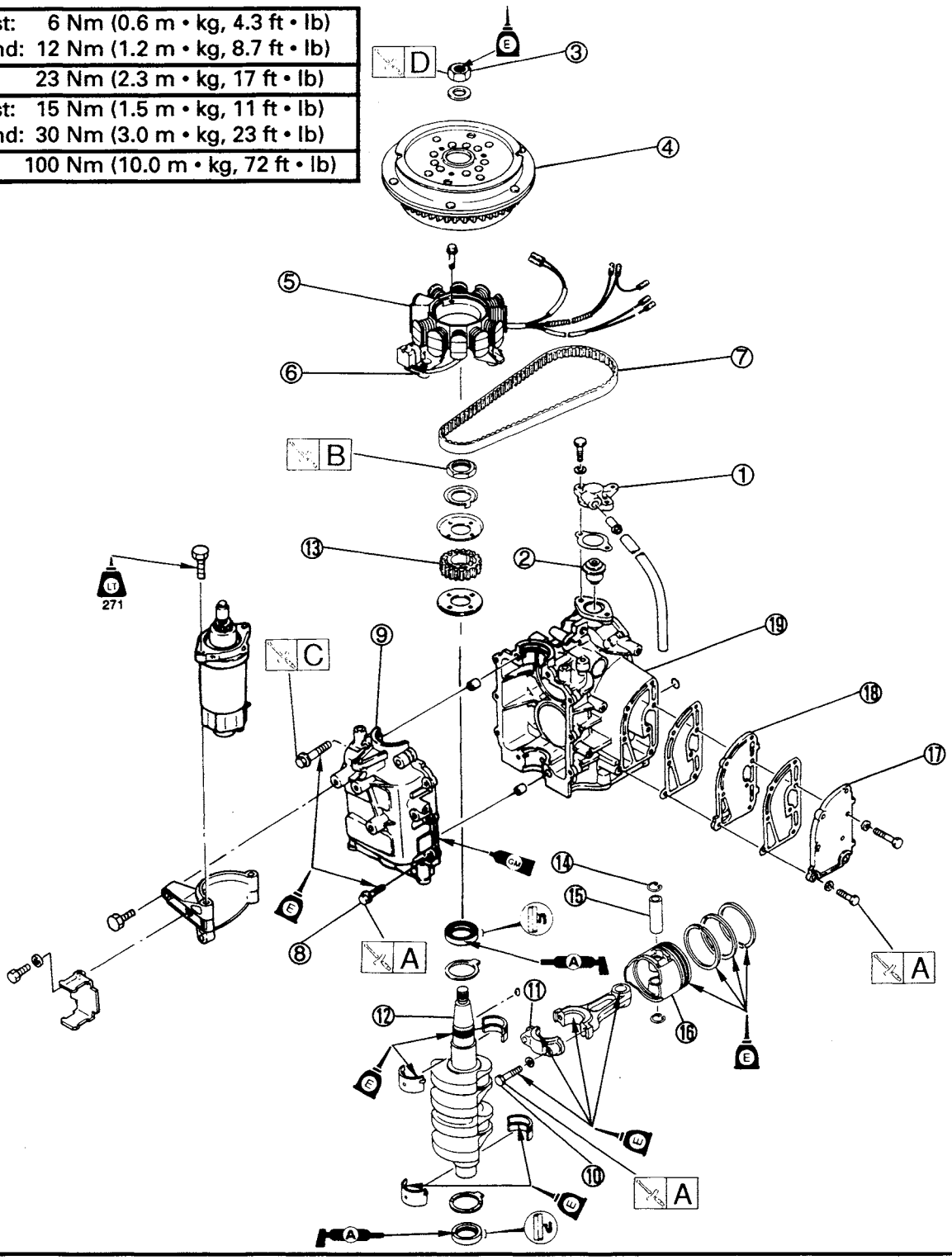
   Refer to page 3-14.

CYLINDER, PISTON AND CRANKSHAFT

PREPARATION FOR REMOVAL

* Remove the power unit.
* Remove the following parts:
  - CDI unit
  - Ignition coil
  - Rectifier regulator

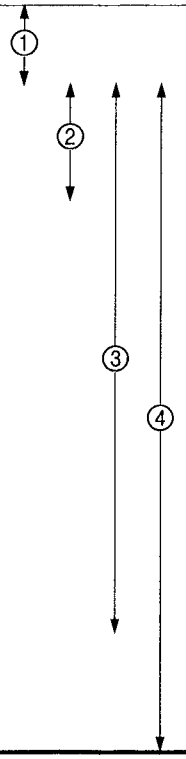
A	1st: 6 Nm (0.6 m • kg, 4.3 ft • lb) 2nd: 12 Nm (1.2 m • kg, 8.7 ft • lb)
B	23 Nm (2.3 m • kg, 17 ft • lb)
C	1st: 15 Nm (1.5 m • kg, 11 ft • lb) 2nd: 30 Nm (3.0 m • kg, 23 ft • lb)
D	100 Nm (10.0 m • kg, 72 ft • lb)

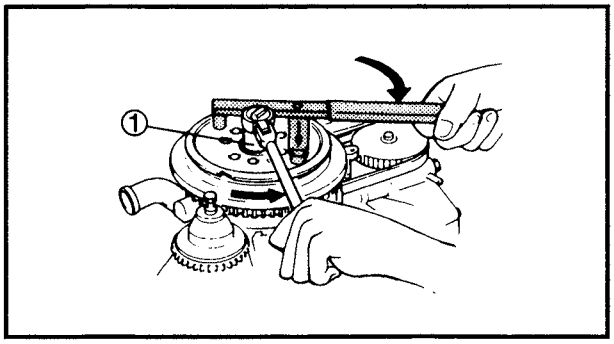


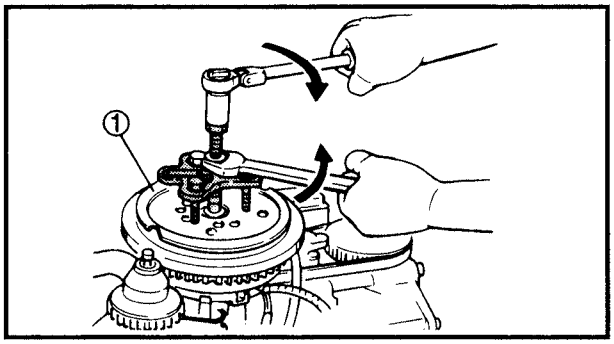
NOTE ON REMOVAL AND REASSEMBLY

- Before servicing, clean the power unit.
- Install the piston and connecting rods in their original cylinders.
- Each connecting rod and its cap should be kept as a set; do not interchange them between cylinders.

Extent of removal: ① Thermostat removal ② Stator assembly removal ③ Piston removal ④ Cylinder body disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
	1	Thermostat cover	1	
	2	Thermostat	1	
	3	Nut	1	
	4	Flywheel magneto	1	Refer to "REMOVAL POINTS".
	5	Stator assembly	1	
	6	Stator bracket	1	
	7	Timing belt	1	Refer to "REMOVAL POINTS".
	8	Bolt	10	
	9	Crankcase	1	
	10	Bolt	4	
	11	Connecting cap	2	
	12	Crankshaft	1	
	13	Drive gear	1	Refer to "REMOVAL POINTS".
	14	Circlip	4	
	15	Piston pin	2	
	16	Piston	2	
	17	Exhaust cover (outer)	1	
	18	Exhaust cover (inner)	1	
	19	Cylinder body	1	

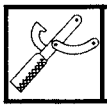




REMOVAL POINTS

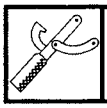
FLYWHEEL MAGNETO

1. Remove:
   - Nut ①

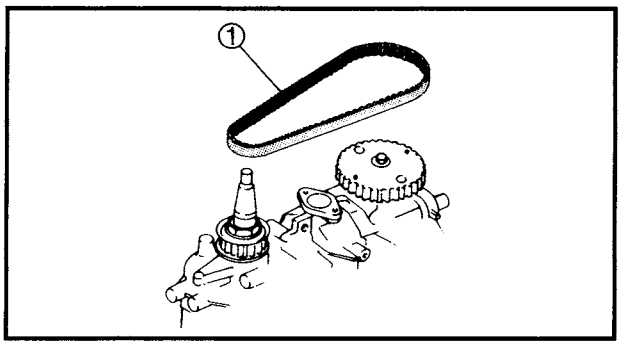


Flywheel holder: YB-6139/90890-06522

2. Remove:
   - Flywheel magneto ①



Flywheel puller: YB-6117/90890-06521

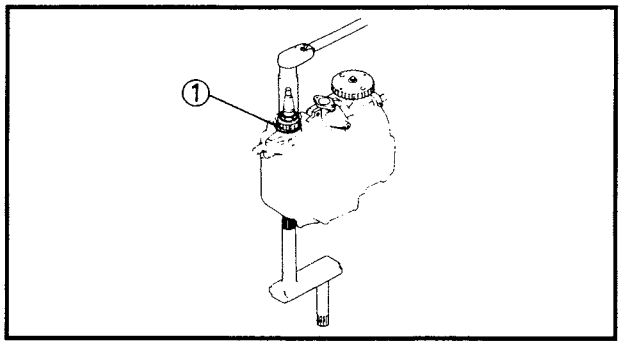


TIMING BELT

1. Remove:
   - Timing belt ①

NOTE:

Remove the timing belt at the driven gear side.



DRIVE GEAR

1. Remove:
   - Lock nut
   - Drive gear ①

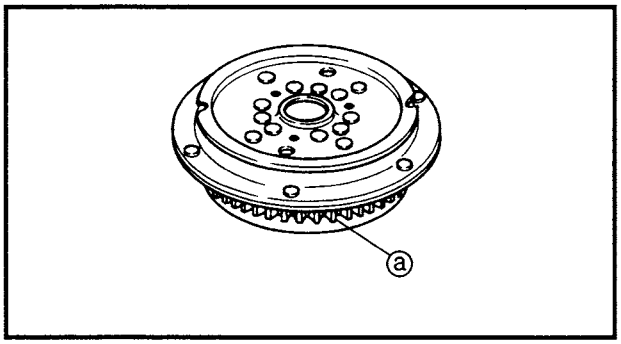
	Shaft holder: /90890-06069

NOTE:

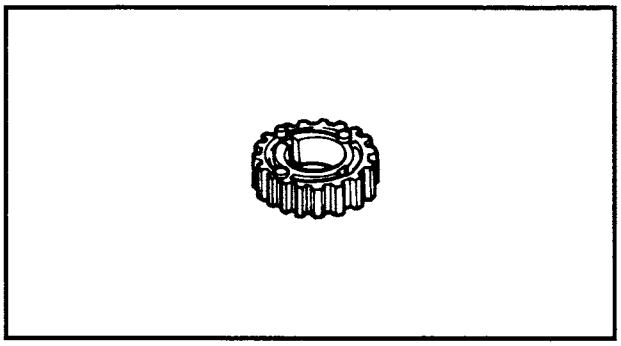
Before removing the lock nut, straighten the lock washer tab.

INSPECTION AND REPAIR

FLYWHEEL MAGNETO

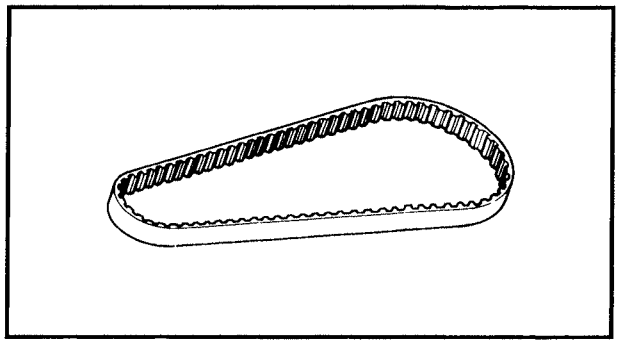


1. Inspect:
   - Flywheel teeth ⓐ
     Wear/Damage → Replace.



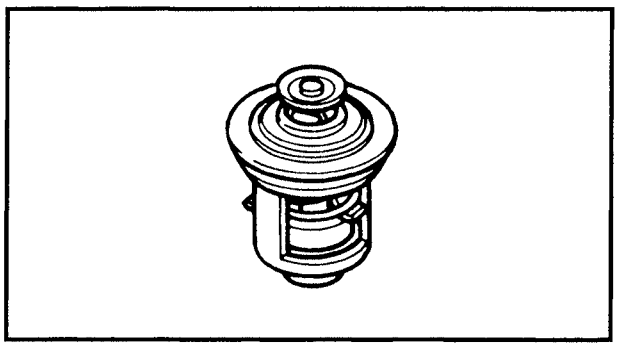
DRIVE GEAR

1. Remove:
   - Drive gear
     Wear/Damage → Replace.



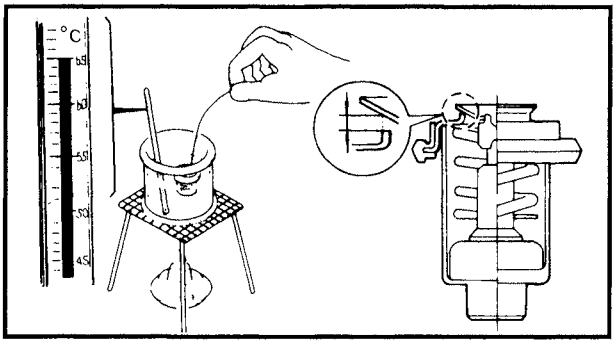
TIMING BELT

1. Inspect:
   - Timing belt
     Stretch/Wear/Damage → Replace.



THERMOSTAT

1. Inspect:
   - Thermostat
     Stick/Damage → Replace.
2. Measure:
   - Valve opening temperature
   - Valve lift
     Out of specification → Replace.

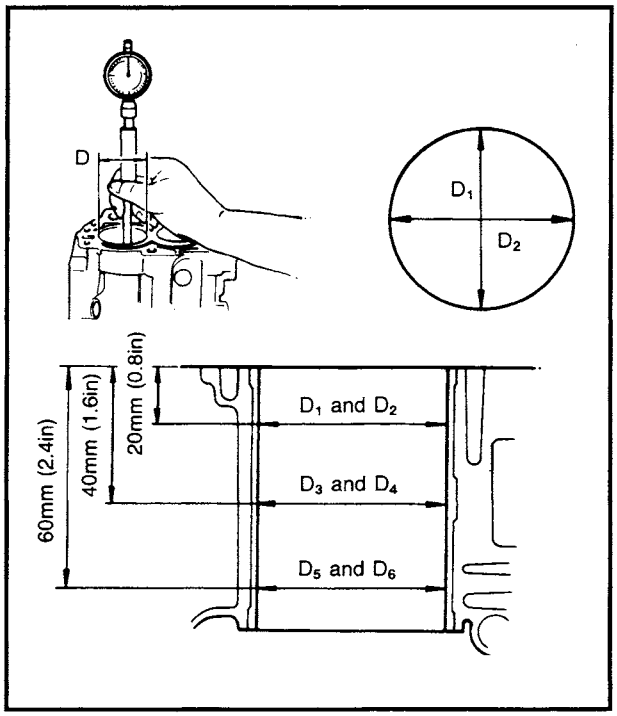


	Water temperature	Valve lift
	Before 58 ~ 62°C (136 ~ 144°F)	0 mm (0 in)
	Above 70°C (158°F)	Min. 3 mm (0.12 in)

Measurement steps:
- Suspend the thermostat in a vessel.
- Place a reliable thermometer in the water.
- Slowly heat the water.
- Observe the thermometer, while continually stirring the water.

CYLINDER

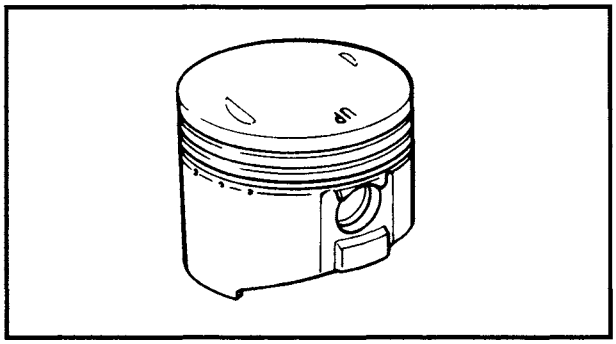
1. Inspect:
   - Water jacket
     Mineral deposits/Corrosion → Clean.
   - Cylinder inner surface
     Score marks → Repair or replace.
     Use #600 ~ 800 grit wet sandpaper.

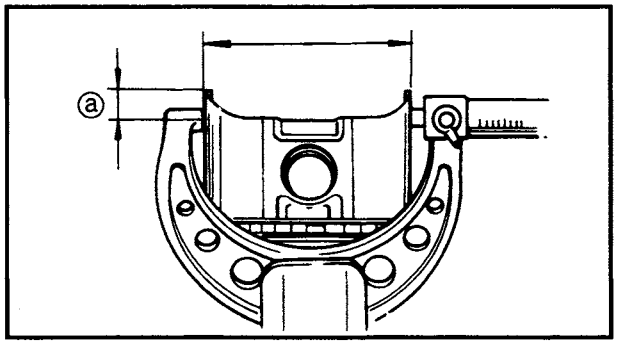


2. Measure:
   - Cylinder bore "D"
     Use cylinder gauge.
     Out of specification → Rebore or Replace.

NOTE:
Measure the cylinder bore "D" in parallel. Then, find the average of the measurement.

	Standard	Wear limit
Cylinder bore D:	59.00 ~ 59.02 mm (2.323 ~ 2.324 in)	59.1 mm (2.326 in)
Cylinder taper T:	—	0.08 mm (0.003 in)
D = Maximum Dia (D_1 ~ D_6) T = (Maximum D_1 or D_2) – Minimum D_5 or D_6)		





PISTON

1. Inspect:
   - Piston wall
     Wear/Scratch/Damage → Replace.
2. Measure:
   - Piston diameter
     Use a micrometer.
     Out of specification → Replace.

	Distance ⓐ	Piston dia.
Standard	10 mm (0.39 in)	58.950 ~ 58.965 mm (2.3209 ~ 2.3215 in)
Oversize 1		59.25 mm (2.333 in)*
2		59.50 mm (2.343 in)

*: Except for USA

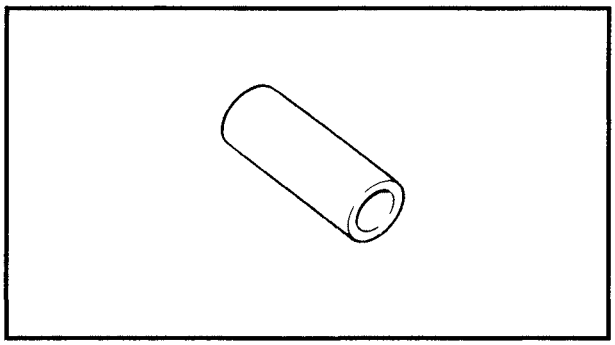
NOTE:
Measure specific distance ⓐ from the bottom edge.

PISTON CLEARANCE

1. Calculate:
   - Piston clearance
     Out of specification → Replace piston and piston ring and/or cylinder.

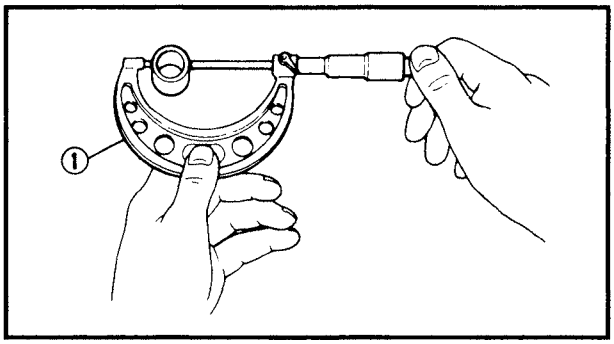
PISTON CLEARANCE	=	CYLINDER BORE	−	PISTON DIAMETER

Piston clearance:
0.035 ~ 0.065 mm
(0.0014 ~ 0.0026 in)



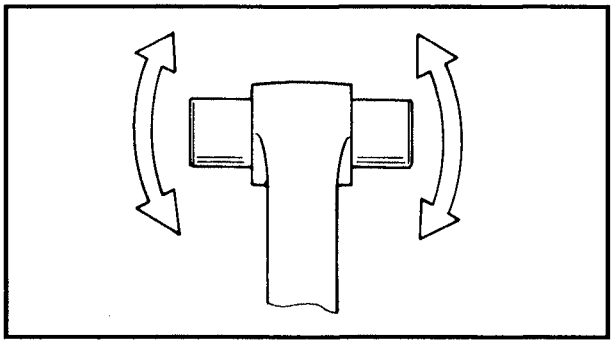
PISTON PIN

1. Inspect:
   - Piston pin
     Signs of heat discoloration → Replace.

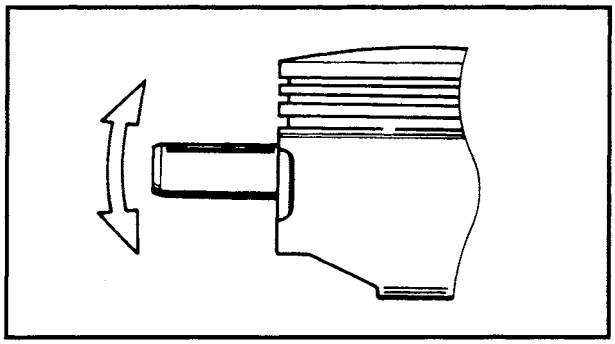


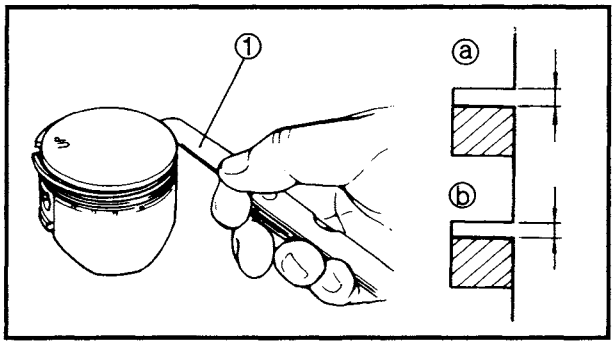
2. Measure:
   - Piston pin diameter
     Use a micrometer ①.
     Out of specification → Replace.

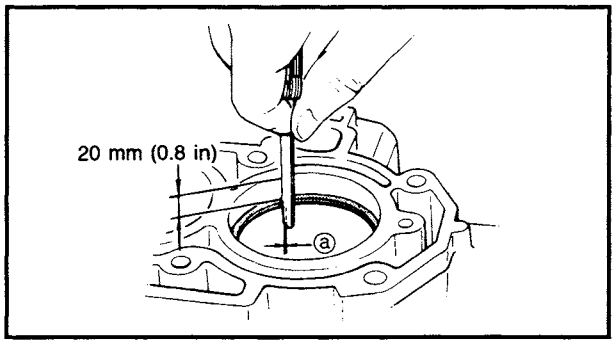
Piston pin diameter:
13.996 ~ 14,000 mm
(0.5510 ~ 0.5512 in)



3. Check:
   - Free play (when the piston pin is into small end of connecting rod.)
     There should be no noticeable play.
     Free play exists → Replace the pin and/or connecting rod as required.







4. Check:
   - Free play
     (when the piston pin is in the piston)
     There should be no noticeable play.
     Free play exists → Replace the pin and/or piston.

PISTON RING

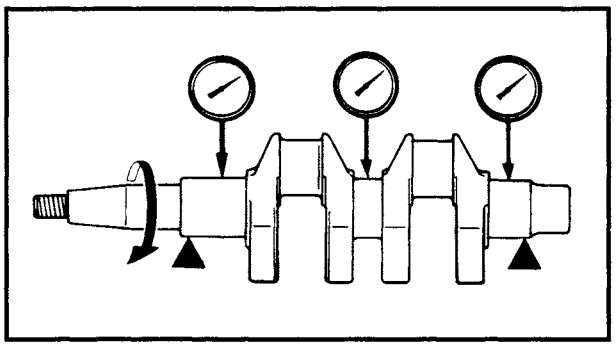
1. Measure:
   - Side clearance ⓐ, ⓑ
     Using a feeler gauge ①.
     Out of specification → Replace piston and/or ring.

	Side clearance:
Top ⓐ	0.04 ~ 0.08 mm (0.002 ~ 0.003 in)
2nd ⓑ	0.03 ~ 0.07 mm (0.001 ~ 0.003 in)

2. Measure:
   - End gap ⓐ
     Using a feeler gauge.
     Out of specification → Replace.

	End gap ⓐ:
Top	0.15 ~ 0.30 mm (0.006 ~ 0.012 in)
2nd	0.15 ~ 0.30 mm (0.006 ~ 0.012 in)
Oil	0.20 ~ 0.70 mm (0.008 ~ 0.028 in)

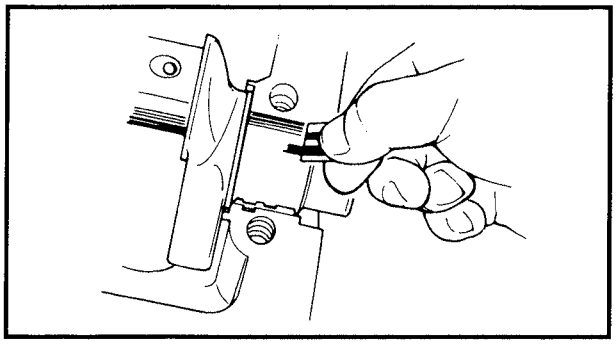
NOTE:
Install the piston ring into the cylinder. Push the ring with the piston crown.



CRANKSHAFT

1. Measure:
   - Runout
     Use V-blocks and a dial gauge.
     Out of specification → Replace.

	Runout: 0.05 mm (0.002 in)



CRANKSHAFT MAIN BEARING CLEARANCE

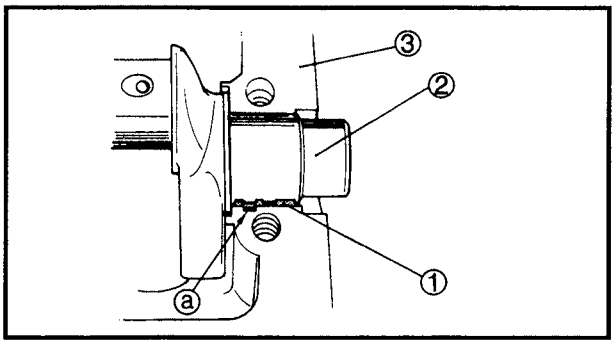
1. Measure:
   - Oil clearance (main journal)
     Out of specification → Replace bearing.

Main bearing clearance:
0.000 ~ 0.027 mm
(0.0000 ~ 0.0011 in)

Measurement steps:

CAUTION:

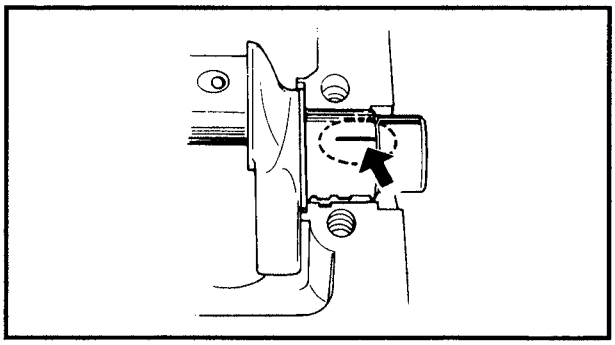
Do not interchange the bearings. They must be installed in their original positions or the correct oil clearance may not be obtained causing engine damage.



- Clean the bearings, main journals and bearing portions of the crankcase and cylinder body.
- Place the cylinder body on a bench in an upside down position.
- Install half of the bearings ① and crankshaft ② into the cylinder body ③.

NOTE:

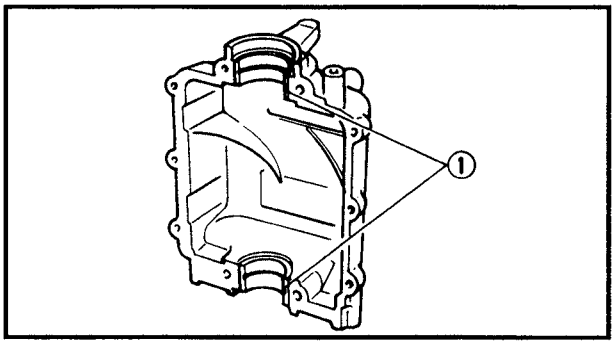
Align the projection ⓐ of the bearing with the notch in the cylinder body.

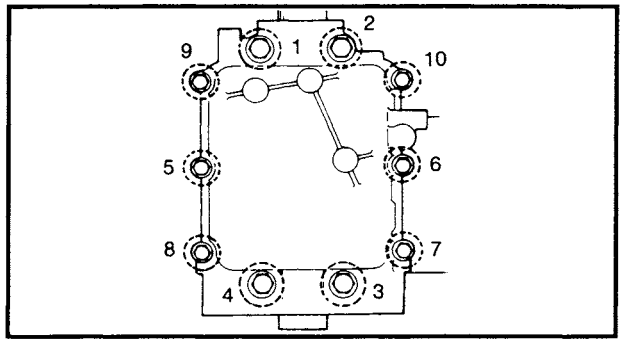


- Put a piece of plastigauge onto the crankshaft journal surface.
- Install half of the bearings ① into the crankcase.

NOTE:

- Align the projection of the bearing with the notch in the crankcase.
- Do not turn crankshaft until clearance measurement has been completed.

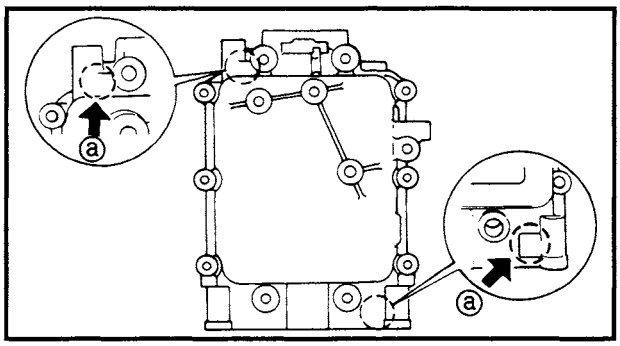


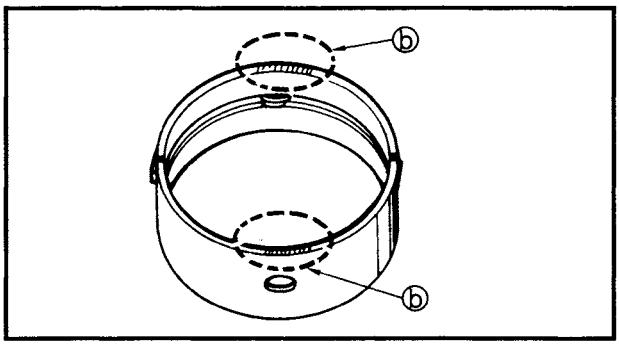


- Tighten the bolts in sequence and two steps of torque.

Bolt (M8):
1st: 15 Nm (1.5 m • kg, 11 ft • lb)
2nd: 30 Nm (3.0 m • kg, 22 ft • lb)
Bolt (M6):
1st: 6 Nm (0.6 m • kg, 4.3 ft • lb)
2nd: 12 Nm (1.2 m • kg, 8.7 ft • lb)

- Remove the bolts and the crankcase.
- Measure the compressed plastigauge width on each main journal.





COMBINATION OF CRANKCASE AND BEARING

1. Crankcase:

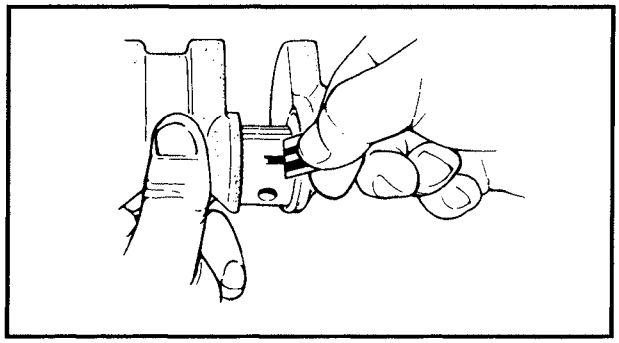
Mark ⓐ	Housing size
A	33.032 ~ 33.040 mm (1.3005 ~ 1.3008 in)
B	33.024 ~ 33.032 mm (1.3002 ~ 1.3005 in)
C	33.016 ~ 33.024 mm (1.2998 ~ 1.3002 in)

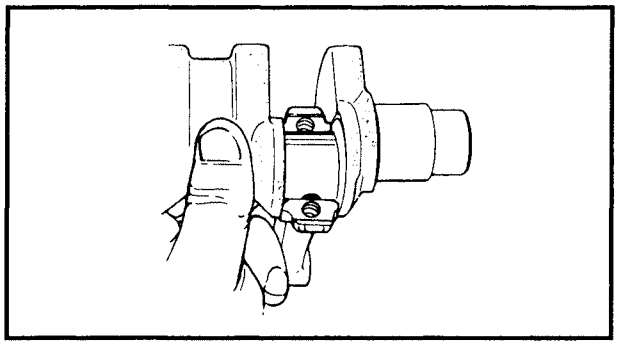
2. Bearing:

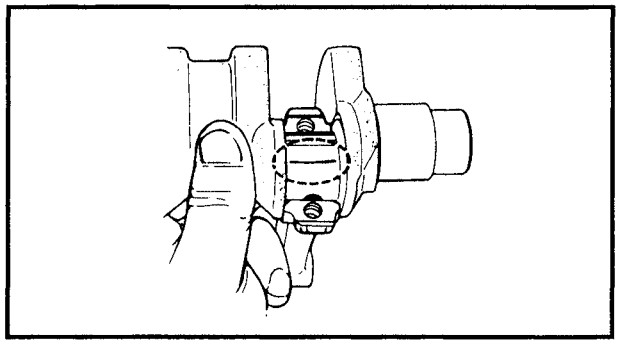
Indication ⓑ	Bearing size
Blue	1.508 ~ 1.512 mm (0.0594 ~ 0.0595 in)
Black	1.504 ~ 1.508 mm (0.0592 ~ 0.0594 in)
Brown	1.500 ~ 1.504 mm (0.0591 ~ 0.0592 in)

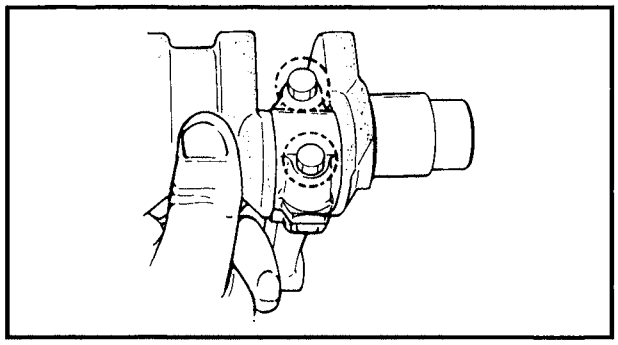
3. Combination:
Combine the crankcase and bearing by the following chart.

Crankcase mark	Bearing indication
A	Blue
B	Black
C	Brown









CONNECTING ROD OIL CLEARANCE

1. Measure:
   - Oil clearance
     Out of specification → Replace connecting rod and cap as a set.

Connecting rod oil clearance:
0.021 ~ 0.045 mm
(0.0008 ~ 0.0018 in)

Measurement steps:

CAUTION:

- **Assemble the connecting rod and the cap referring the marking.**
- **Do not assemble connecting rod and the cap with #1 and #2 together.**

- Clean the bearing portions of the connecting rod.
- Install the connecting rod to the crankshaft.
- Put a piece of plastigauge onto the crank pin.
- Install the connecting rod cap.

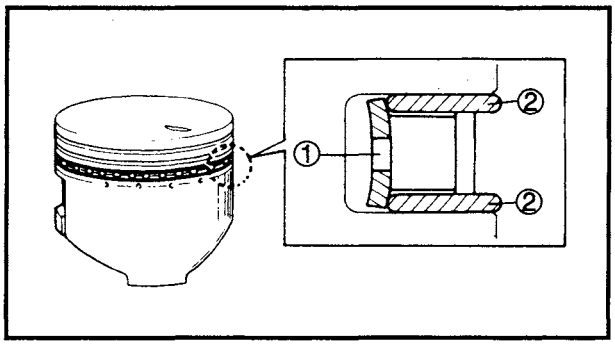
NOTE:

- Make sure that the "6G803" marks on the connecting rods face toward the flywheel side of the crankshaft.
- Do not turn the connecting rod or crankshaft until clearance measurement has been completed.

- Tighten the bolts in sequence in two steps of torque.

Bolt (M8):
1st: 6 Nm (0.6 m • kg, 4.3 ft • lb)
2nd: 12 Nm (1.2 m • kg, 8.7 ft • lb)

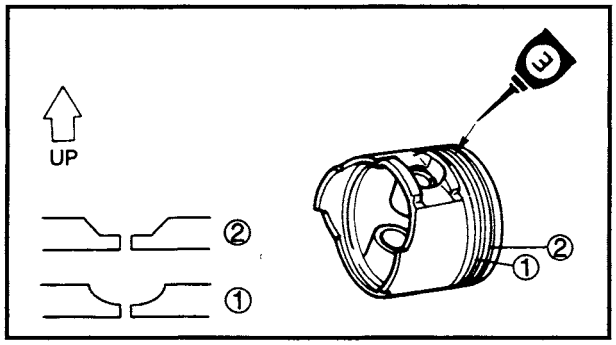
- Remove the bolts and the connecting rod cap.
- Measure the compressed plastigauge width on each crank pin.



ASSEMBLY AND INSTALLATION

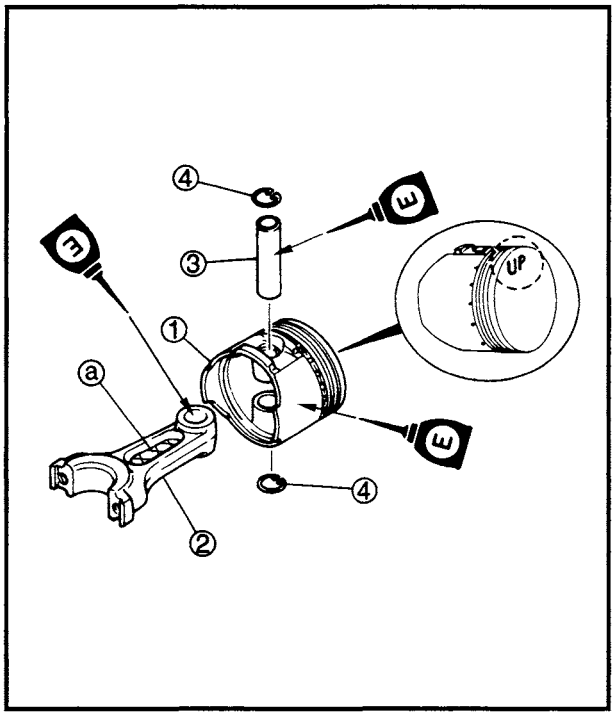
PISTON AND CONNECTING ROD

1. Install:
   - Expander ring ①
   - Side ring ②



2. Install:
   - Piston ring (2nd) ①
   - Piston ring (top) ②

NOTE:
- Align the piston ring gap with the pin of the piston.
- Oil the pistons and rings liberally.

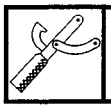


3. Install:
   - Piston ①
   - Connecting rod ②
   - Piston pin ③
   - Circlip ④

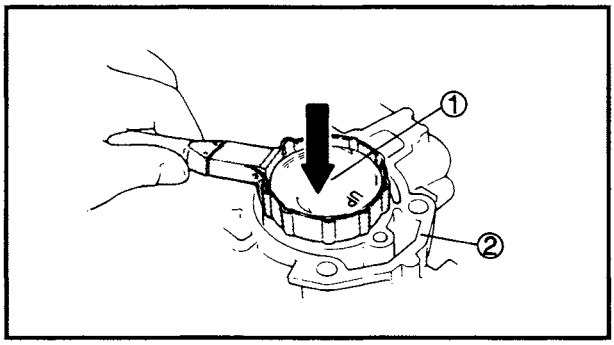
NOTE:
- Mold mark ⓐ faces in the same direction as the "UP" mark on the piston.
- Always use a new circlip.
- Oil the pistons, piston pins and connecting rods liberally.

CYLINDER AND CRANKCASE

1. Install:
   - Piston assembly ①
   - Cylinder body ②

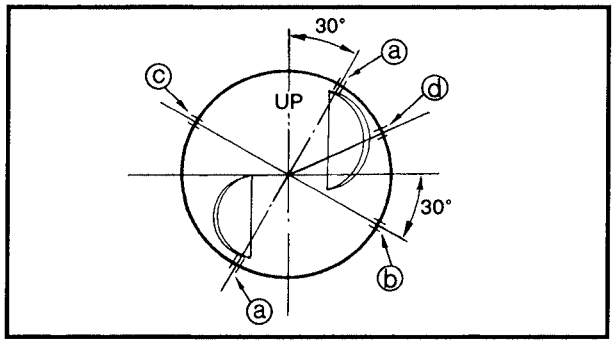


Piston slider:
YB-34454/90890-06529



CAUTION:

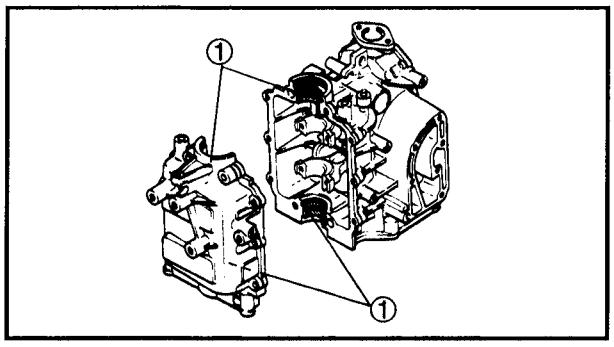
The piston should be installed with the "UP" mark on the piston crown facing toward the flywheel side.



NOTE:
- Position the ring end gaps before inserting the piston.
- Align the piston ring gap (top and 2nd) with the pin of the piston.

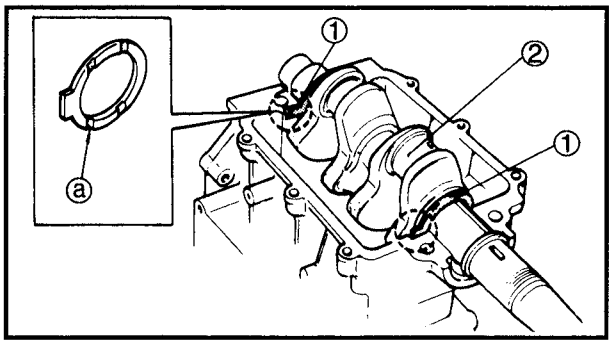
ⓐ Side rail end gap
ⓑ Expander ring end gap
ⓒ Piston ring (2nd) end gap
ⓓ Piston ring (top) end gap

2. Install:
   - Crankshaft main bearing ①



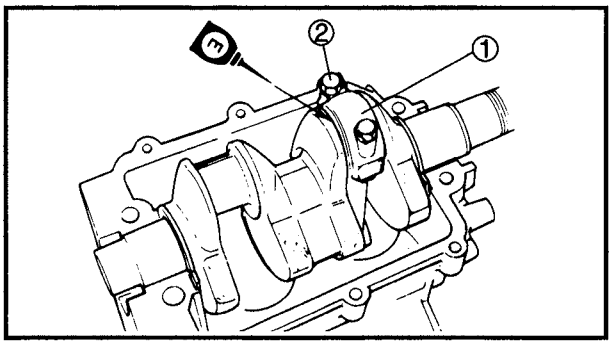
NOTE:
Align the projection of the bearings with the notch in the cylinder body and crankcase.

3. Install:
   - Thrust plate ①
   - Crankshaft ②

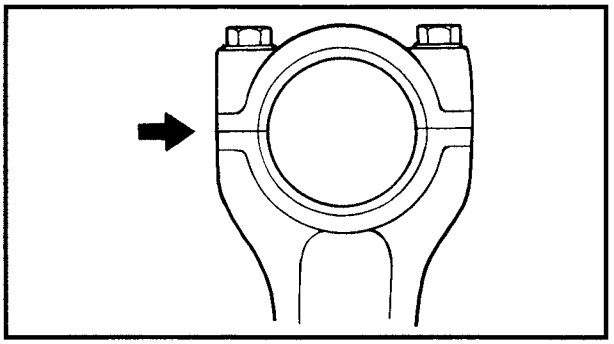


NOTE:
- Install the thrust plates so that the oil groove ⓐ side is on the crank side.
- When installing the crankshaft on the cylinder body, be sure to fit the thrust plate tab in the cut of the cylinder body.

4. Install:
   - Connecting cap ①
   - Bolt ②

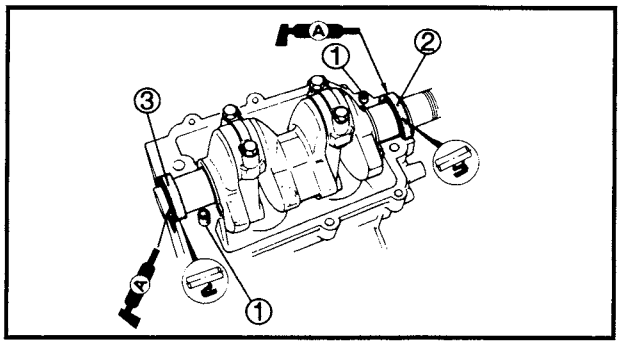


CAUTION:
- **Assemble the connecting rod and its cap referring the marking.**
- **Do not assemble connecting rod and cap with #1 and #2 together.**



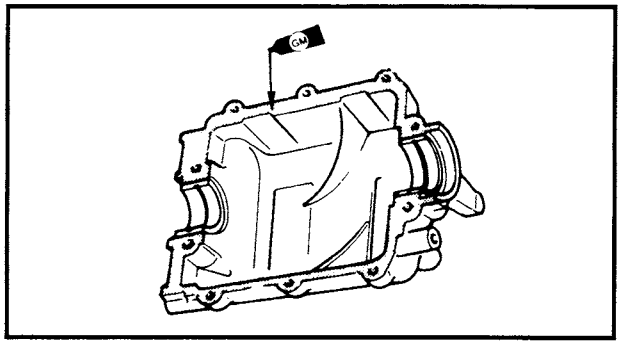
NOTE:
Oil the connecting cap and crank pin liberally.

Bolt:
1st: 6 Nm (0.6 m • kg, 4.3 ft • lb)
2nd: 12 Nm (1.2 m • kg, 8.7 ft • lb)



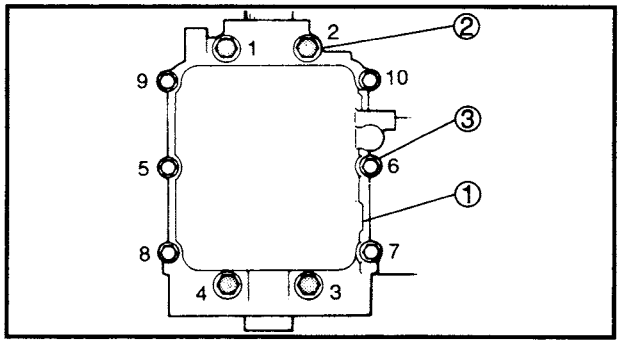
5. Install:
   - Dowel pin ①
   - Oil seal (upper) ②
   - Oil seal (lower) ③

NOTE:
Install the oil seal with its manufacture's marks or numbers facing outward.



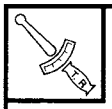
6. Apply:
   - Gasket Maker
     Onto the crankcase.

NOTE:
- Clean the contacting surface of the crankcase and cylinder body before applying the Gasket maker.
- Gasket maker should be applied so it does not overflow the contacting surface.

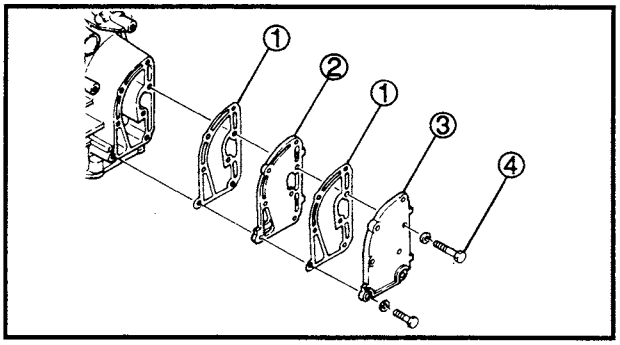


7. Install:
   - Crankcase ①
   - Bolt (M8) ②
   - Bolt (M6) ③

NOTE:
Tighten the bolts in sequence in two steps of torque.



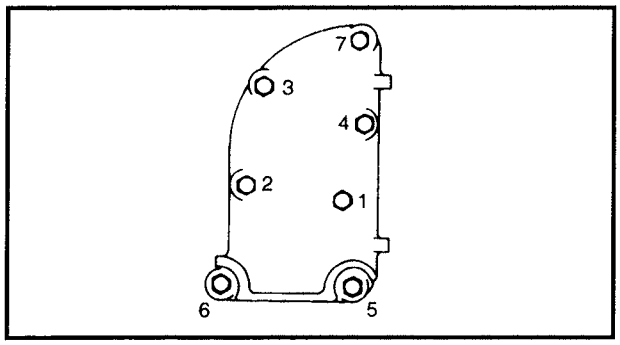
Bolt:
M8 1st:
15 Nm (1.5 m • kg, 11 ft • lb)
2nd:
30 Nm (3.0 m • kg, 22 ft • lb)
M61st:
6 Nm (0.6 m • kg, 4.3 ft • lb)
2nd:
12 Nm (1.2 m • kg, 8.7 ft • lb)

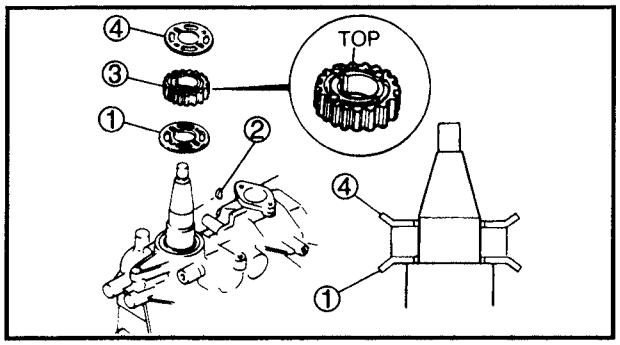


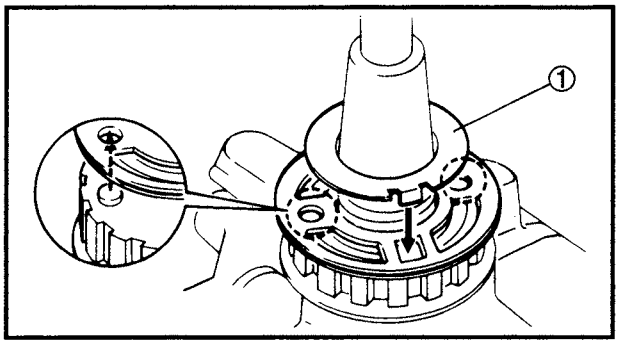
EXHAUST COVER

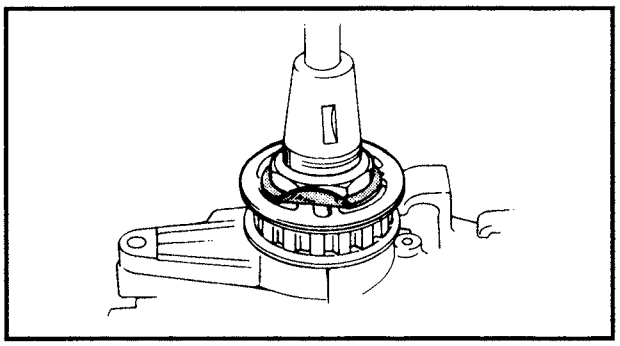
1. Install:
   - Gasket ①
   - Exhaust cover (inner) ②
   - Exhaust cover (outer) ③
   - Bolt ④

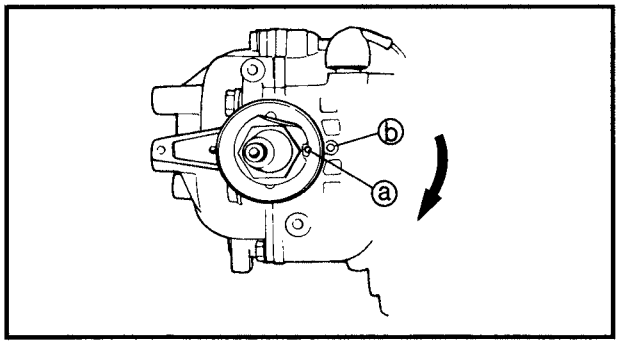
NOTE:
Tighten the bolts in sequence in two steps of torque.











TIMING BELT

1. Install:
   - Washer ①
   - Woodruff key ②
   - Drive gear ③
   - Washer ④

NOTE:

- The projections on the drive gear should fit into the holes in the washers.
- "TOP" mark side should face upward.

2. Install:
   - Lock washer ①
   - Nut

NOTE:

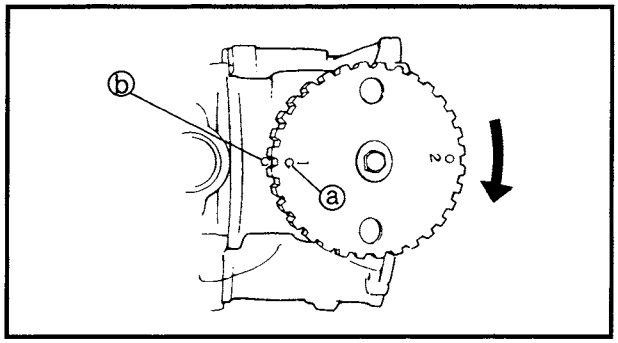
- Insert the projection of the lock washer to be matched with the "TOP" mark.
- After tightening the nut, bend the lock washer over the nut.

	Shaft holder: /90890-06069
	Nut: 23 Nm (2.3 m • kg, 17 ft • lb)

3. Align:
   - Drive gear mark ⓐ
   - Cylinder body mark ⓑ

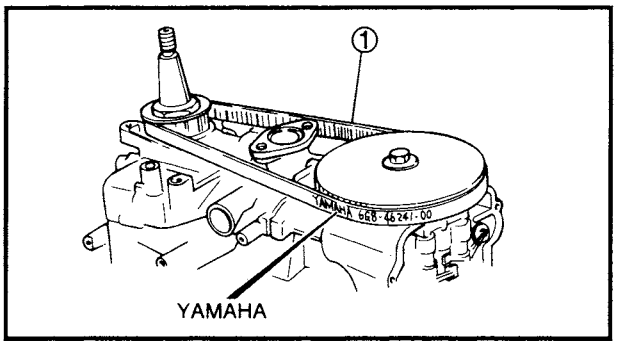
NOTE:

Turn the crankshaft clockwise.



4. Align:
   - Driven gear mark ⓐ
   - Cylinder head mark ⓑ

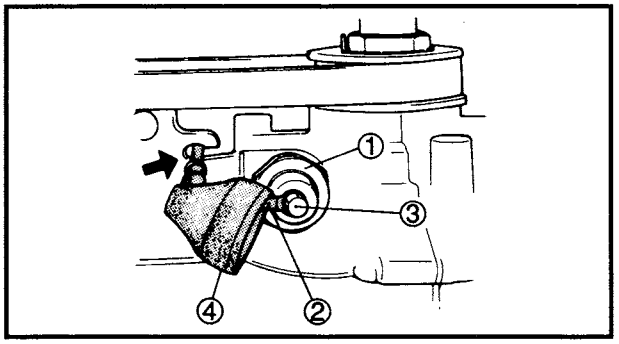
NOTE:
Turn the camshaft clockwise.



5. Install:
   - Timing belt ①

CAUTION:
- **Protect the belt from water and oil.**
- **Do not use an iron lever when installing the belt.**
- **Use care not to scratch the belt.**

NOTE:
- Make sure that the "YAMAHA" mark is not inverted.
- Place the timing belt around the drive gear and then around the driven gear.
- When placing the timing belt around the driven gear, lock both drive and driven gears so that they do not turn.



OIL PRESSURE SWITCH

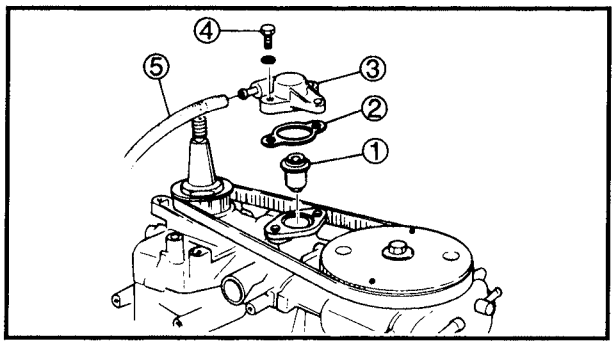
1. Install:
   - Oil pressure switch ①

	Oil pressure switch: **9 Nm (0.9 m • kg, 6.5 ft • lb)**

2. Install:
   - Switch lead ②
   - Screw ③
   - Cover ④

NOTE:
Route the switch lead over the recess in the cylinder body.

	Screw: **2 Nm (0.2 m • kg, 1.4 ft • lb)**

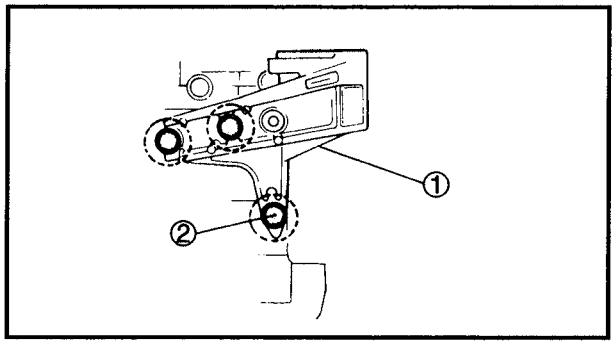


THERMOSTAT

1. Install:
   - Thermostat ①
   - Gasket ②
   - Thermostat cover ③
   - Bolt ④
   - By-pass hose ⑤

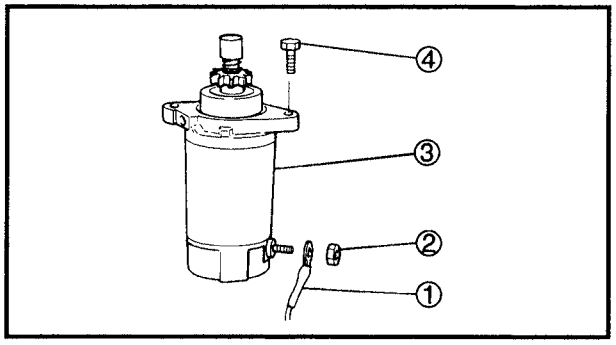
NOTE:

Always use a new gasket.



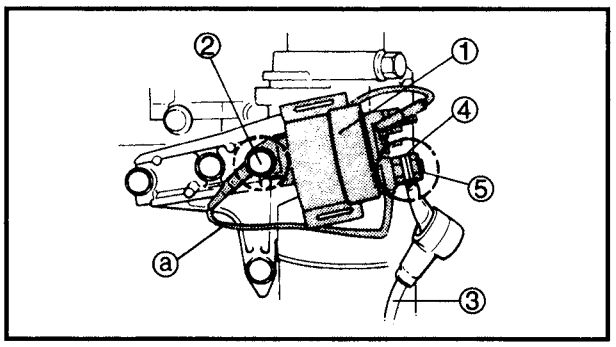
STARTER MOTOR

1. Install:
   - Bracket ①
   - Bolt ②



2. Install:
   - Battery lead ①
   - Nut ②
   - Starter motor ③
   - Bolt ④

	Nut: **4 Nm (0.4 m • kg, 2.9 ft • lb)**

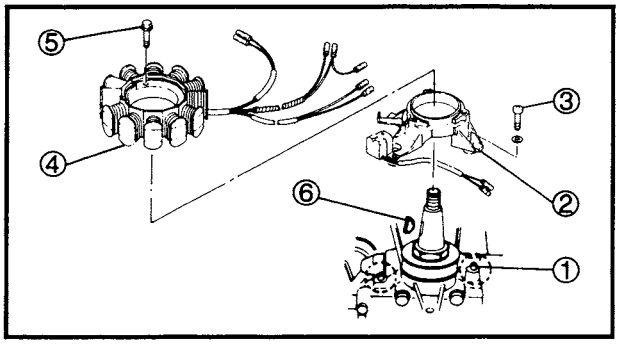


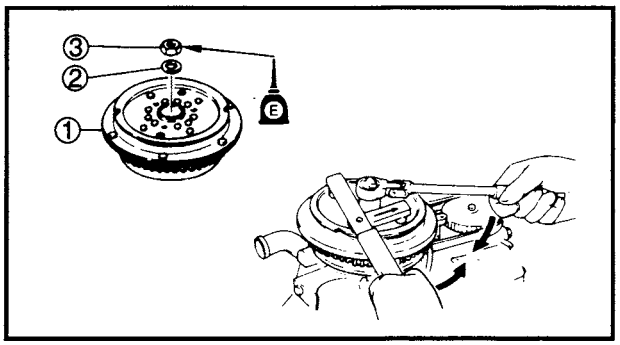
3. Install:
   - Relay bracket
   - Starter relay assembly ①
   - Bolt ②
   - Battery lead ③
   - Washer ④
   - Nut ⑤

NOTE:

- Secure, together with the starter relay ground lead ⓐ.
- Connect the battery lead to both of the starter motor and starter relay.

	Nut: **4 Nm (0.4 m • kg, 2.9 ft • lb)**

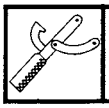
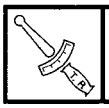




FLYWHEEL MAGNETO

1. Install:
   - Dowel pin ①
   - Stator bracket ②
   - Screw ③
   - Stator assembly ④
   - Bolt ⑤
   - Woodruff key ⑥

2. Install:
   - Flywheel magneto ①
   - Washer ②
   - Nut ③

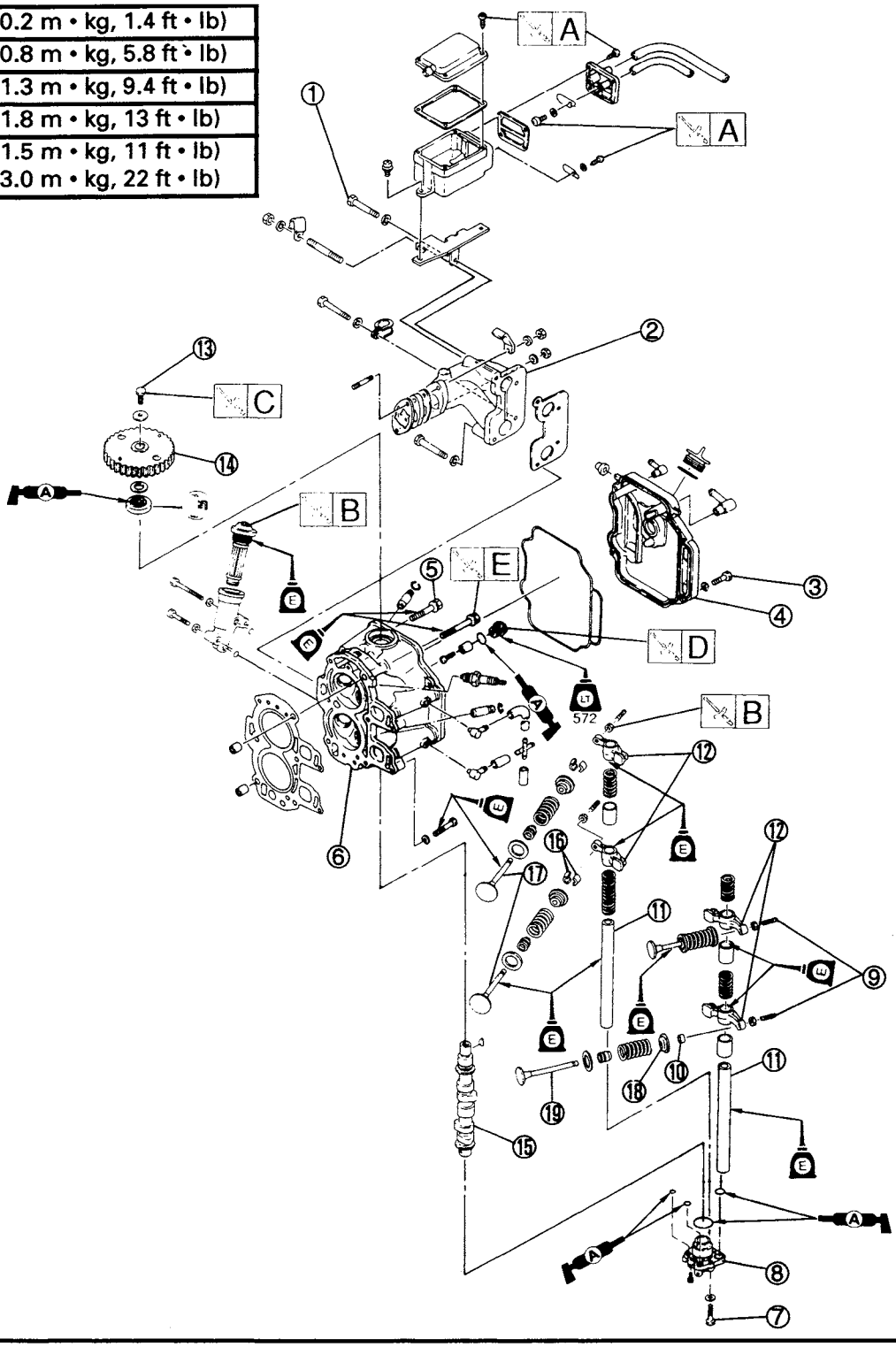
	**Flywheel holder:** **YB-6139/90890-06522**
	**Nut:** **100 Nm (10.0 m • kg, 72 ft • lb)**

CYLINDER HEAD, VALVE AND CAMSHAFT

PREPARATION FOR REMOVAL

* Remove the power unit.
* Remove the following parts:
  - CDI unit
  - Ignition coil
  - Stator assembly
  - Rectifier regulator
  - Flywheel magneto
  - Timing belt

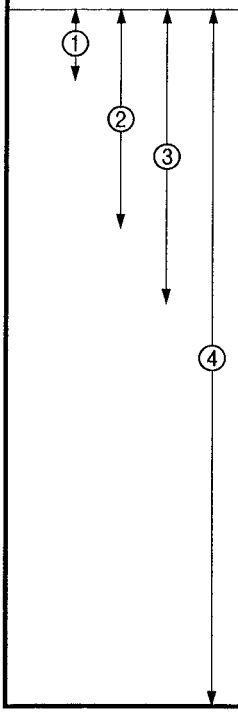
A	2 Nm (0.2 m • kg, 1.4 ft • lb)
B	8 Nm (0.8 m • kg, 5.8 ft • lb)
C	13 Nm (1.3 m • kg, 9.4 ft • lb)
D	18 Nm (1.8 m • kg, 13 ft • lb)
E	1st: 15 Nm (1.5 m • kg, 11 ft • lb) 2nd: 30 Nm (3.0 m • kg, 22 ft • lb)

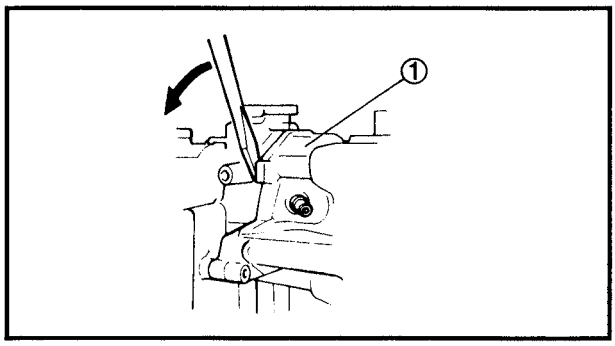


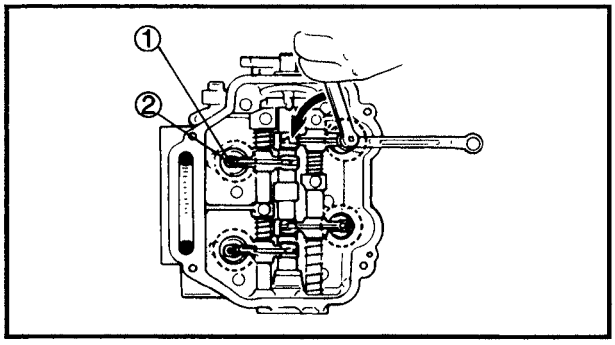
NOTE ON REMOVAL AND REASSEMBLY

- Before servicing, clean the power unit.
- Remove any gasket adhered to the contacting surface.
- Take care not to scratch the contacting surfaces when removing the cylinder and cylinder head.
- For reassembly, clean the removed parts with solvent and apply gear oil to the sliding surfaces.

Extent of removal: ① Intake manifold removal ② Cylinder head removal ③ Oil pump assembly removal ④ Valve disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
	1	Bolt	3	
	2	Intake manifold	1	
	3	Bolt	4	
	4	Cylinder head cover	1	
	5	Bolt	8	
	6	Cylinder head	1	Refer to "REMOVAL POINTS".
	7	Bolt	3	
	8	Oil pump assembly	1	
	9	Adjust screw	4	Loosen the screw.
	10	Valve lifter	2	Refer to "REMOVAL POINTS".
	11	Rocker shaft	2	
	12	Rocker arm	4	
	13	Bolt	1	
	14	Driven gear	1	Refer to "REMOVAL POINTS".
	15	Camshaft	1	
	16	Valve cotter	4	
	17	Valve (intake)	2	Refer to "REMOVAL POINTS".
	18	Spring retainer	2	
	19	Valve (exhaust)	2	





REMOVAL POINTS

CYLINDER HEAD

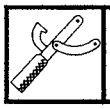
1. Remove:
   - Cylinder head ①

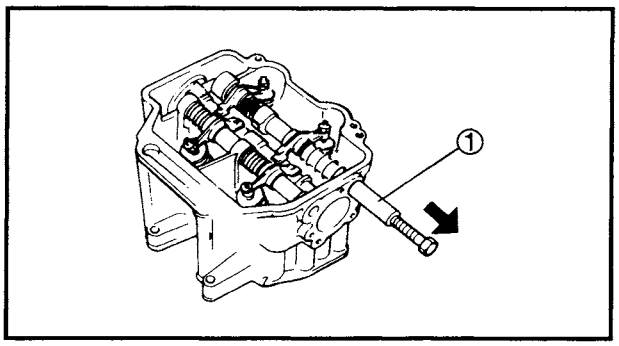
NOTE:

- To remove the cylinder head, insert a screwdriver between the cylinder head and cylinder body, and then separate it.
- Do not to scratch the gasket contact surfaces with the screwdriver.

ROCKER SHAFT

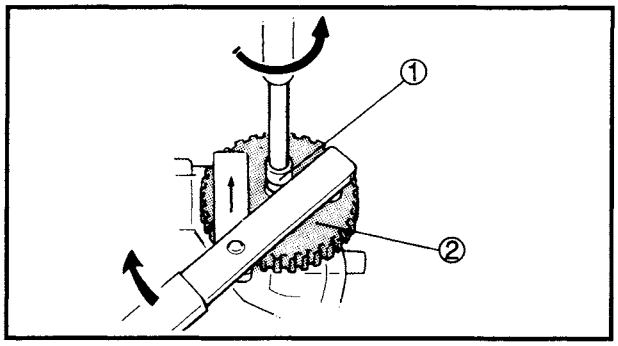
1. Loosen:
   - Lock nut ①
   - Adjust screw ②

	**Valve adjuster: YB-8035/90890-01311**



2. Remove:
- Rocker shaft ①

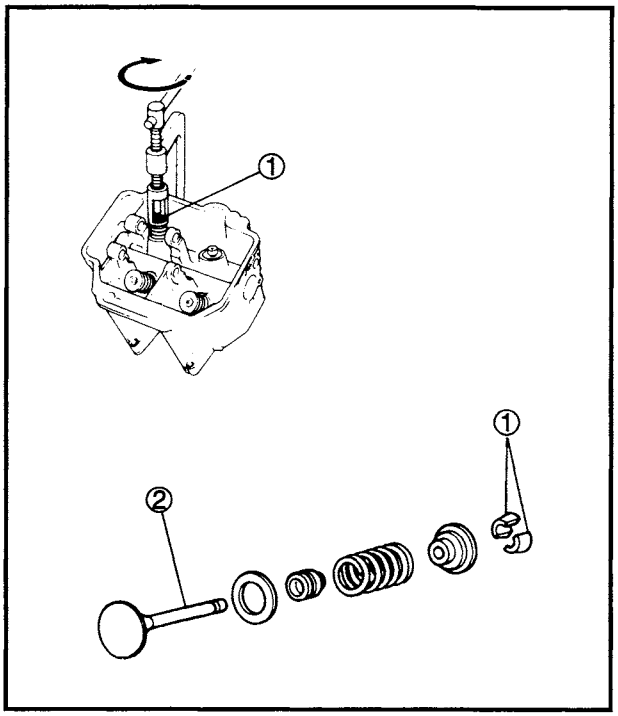
NOTE:
Use M10 bolt to extract the rocker shaft.



DRIVEN GEAR

1. Remove:
- Bolt ①
- Driven gear ②

	Flywheel holder: YB-6139/90890-06522



VALVE

1. Remove:
- Valve cotter ①
- Valve ②

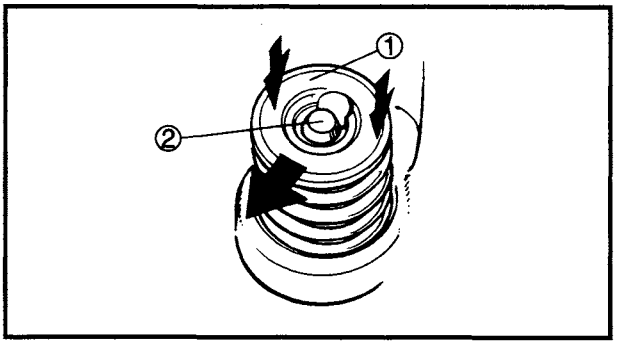
	Valve spring compressor: YM-1253/90890-04019

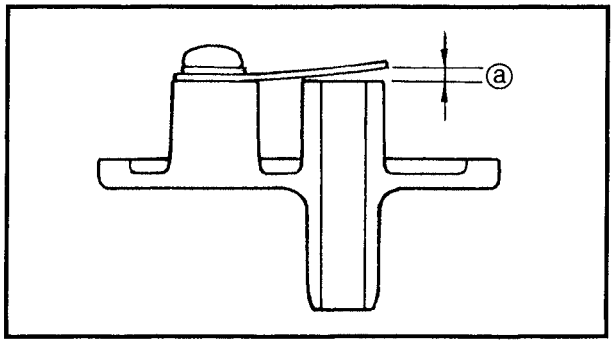
NOTE:
Hold down the valve spring and remove the valve cotter.

2. Remove:
- Valve lifter
- Spring retainer ①
- Valve ②

	Valve spring compressor: YM-1253/90890-04019

NOTE:
Hold down the valve spring, remove the valve lifter and slide out the retainer.



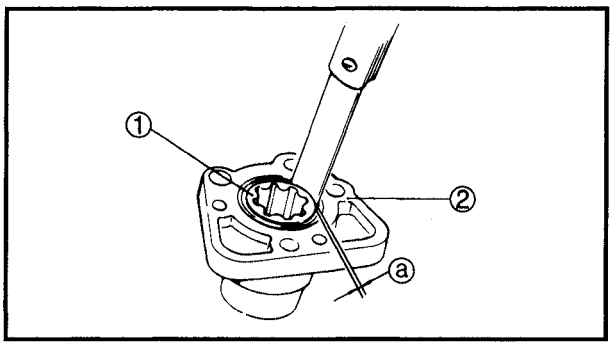


INSPECTION AND REPAIR

OIL SEPARATOR

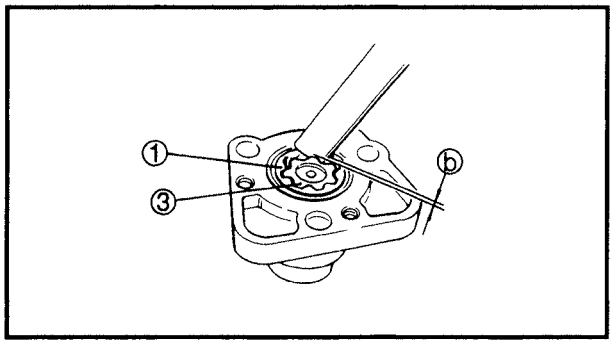
1. Measure:
   - Reed valve warpage ⓐ
     Out of specification → Replace.

	Reed valve warpage limit: 0.2 mm (0.008 in)

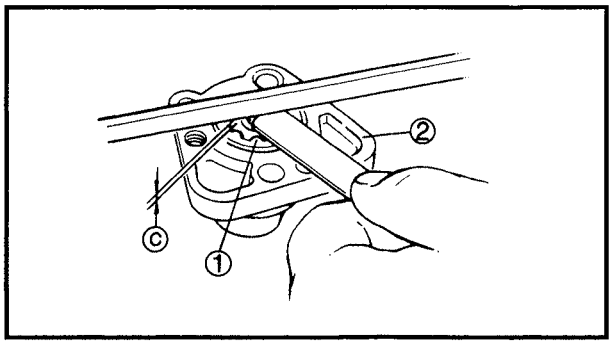


OIL PUMP

1. Measure:
   - Clearance ⓐ
     (between outer rotor ① and pump housing ②)
   - Clearance ⓑ
     (between inner rotor ③ and outer rotor ①)
   - Clearance ⓒ
     (between outer rotor ① and pump housing ②)
     Use a feeler gauge.
     Out of specification → Replace oil pump assembly.

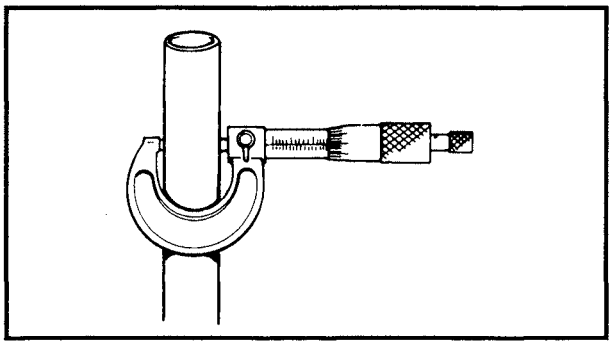


	Clearance:
ⓐ	0.06 ~ 0.11 mm (0.0024 ~ 0.0043 in)
ⓑ	0.02 ~ 0.15 mm (0.0008 ~ 0.0059 in)
ⓒ	0.02 ~ 0.07 mm (0.0020 ~ 0.0028 in)

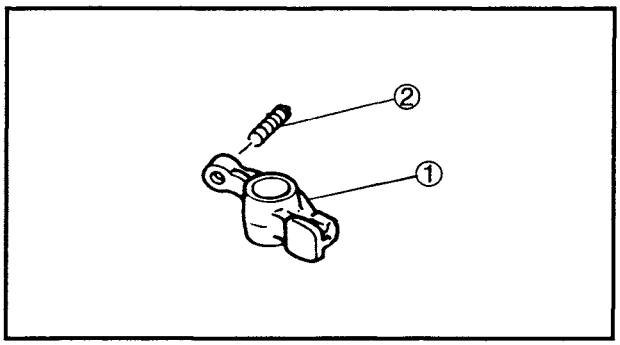


ROCKER SHAFT AND ROCKER ARM

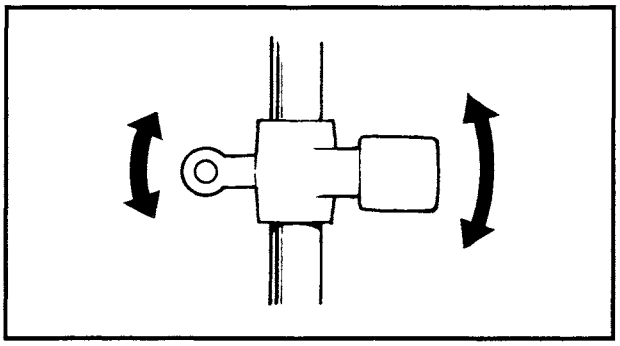
1. Measure:
   - Rocker shaft diameter
     Out of specification → Replace.



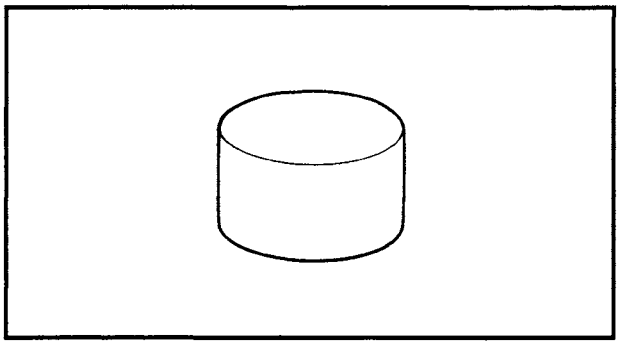
	Rocker shaft diameter: 12.941 ~ 12.951 mm (0.5095 ~ 0.5099 in)



2. Inspect:
   - Rocker arm ①
     Scratch/Damage → Replace.
   - Adjust screw ②
     Wear/Damage → Replace.

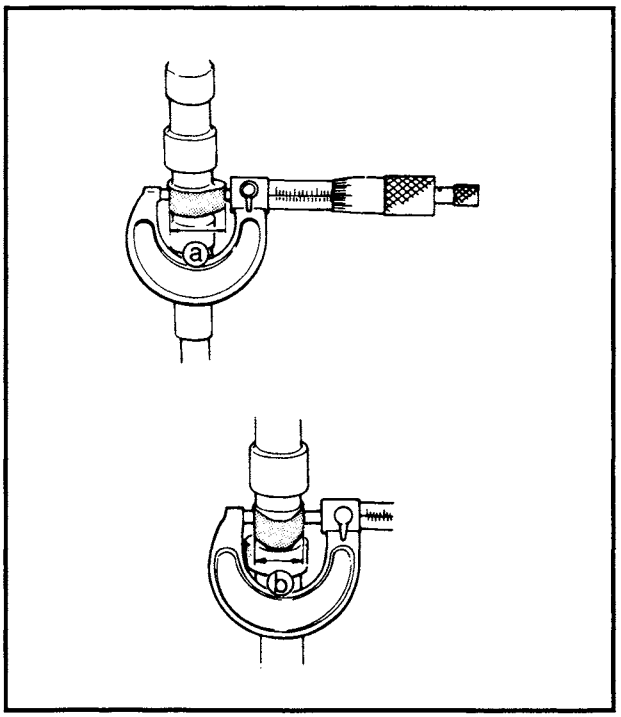


3. Check:
   - Free play (when the rocker shaft is in place of the rocker arm)
     There should be no noticeable play.
     Free play exists → Replace the rocker shaft and/or rocker arm.



VALVE LIFTER

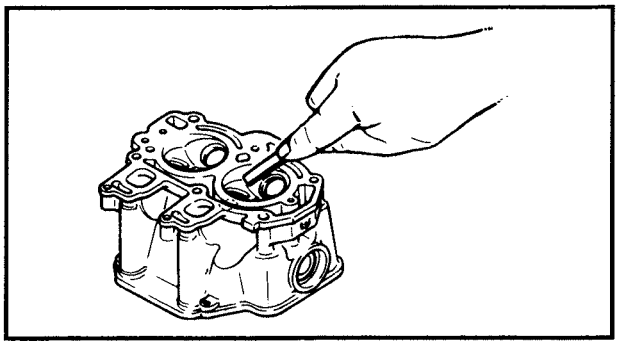
1. Inspect:
   - Valve lifter
     Scratch/Damage → Replace.



CAMSHAFT

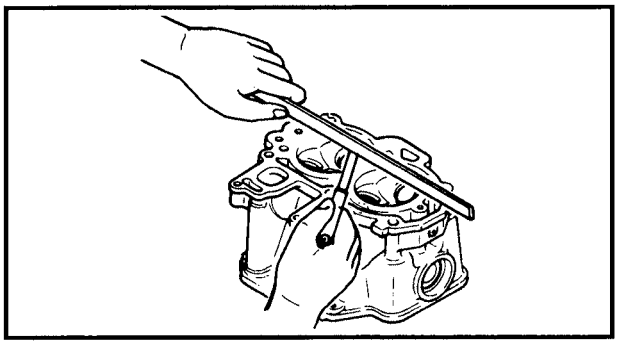
1. Inspect:
   - Cam lobes
     Pitting/Scratch/Blue discoloration → Replace.
2. Measure:
   - Cam lobe length ⓐ
   - Cam lobe length ⓑ
     Out of specification → Replace.

		Cam lobe length:
ⓐ	IN	24.541 ~ 24.641 mm (0.966 ~ 0.970 in)
	EX	24.578 ~ 24.678 mm (0.968 ~ 0.972 in)
ⓑ	IN	20.137 ~ 20.237 mm (0.793 ~ 0.797 in)
	EX	20.178 ~ 20.278 mm (0.794 ~ 0.798 in)



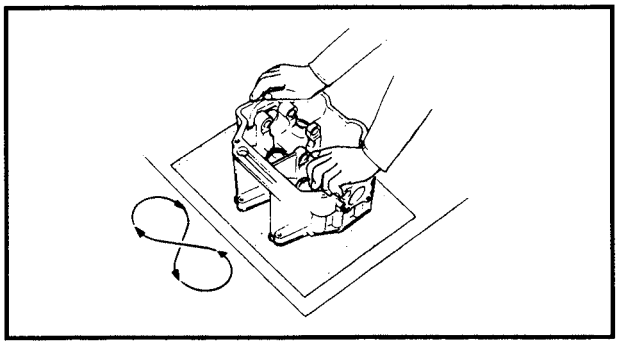
CYLINDER HEAD

1. Inspect:
   - Water jacket
     Mineral deposits/Corrosion → Clean.
   - Combustion chamber
     Carbon deposits → Clean.
     Use a round scraper.



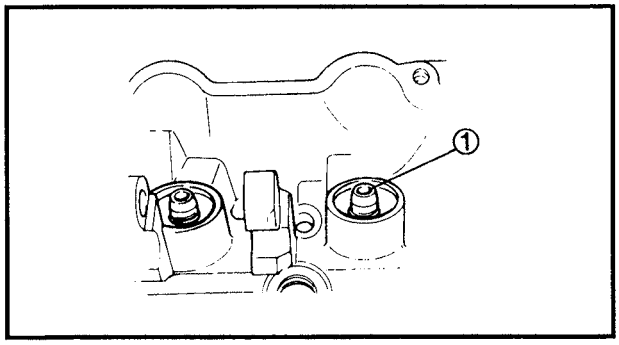
2. Measure:
   - Cylinder head warpage
     Use a straightedge and thickness gauge.
     Out of specification → Replace the valve

Warpage limit:
0.1 mm (0.004 in)

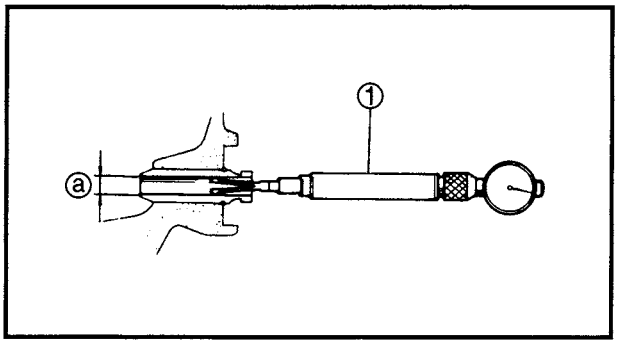


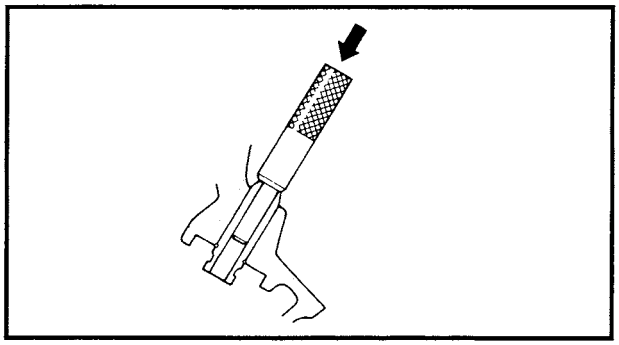
Resurfacing steps:
- Place a 400 ~ 600 grit wet sandpaper on the surface plate.
- Resurface the head using a figure-eight sanding pattern.

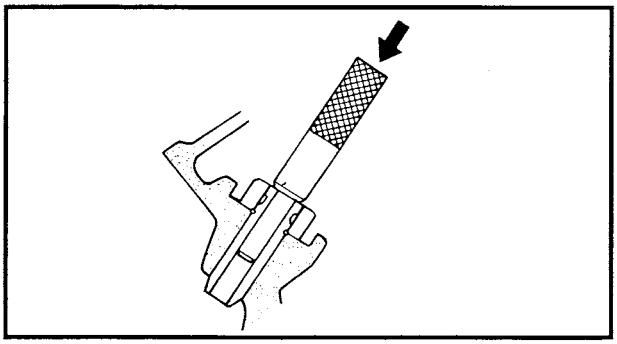
NOTE:
Rotate the head several times to avoid removing too much material from one side.

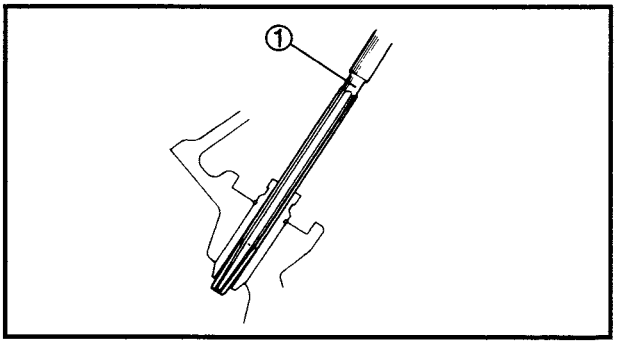


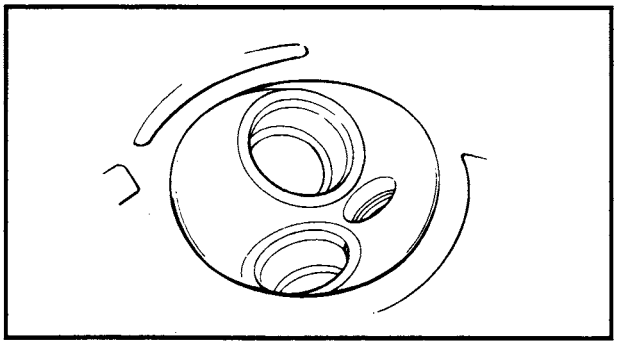
3. Inspect:
   - Valve guide ①
     Wear/Damage → Replace.











4. Measure:
   - Valve guide bore ⓐ
     Use a bore gauge ①.
     Out of specification → Replace the valve guide.

	Valve guide bore:
IN EX	5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in)

Replacement steps:

NOTE:
Heat the cylinder head in an oven to 200°C (392°F) to ease guide removal and installation and to maintain correct interference fit.

- Remove the valve guide using the valve guide remover.

Valve guide remover:
YM-1122/90890-06801

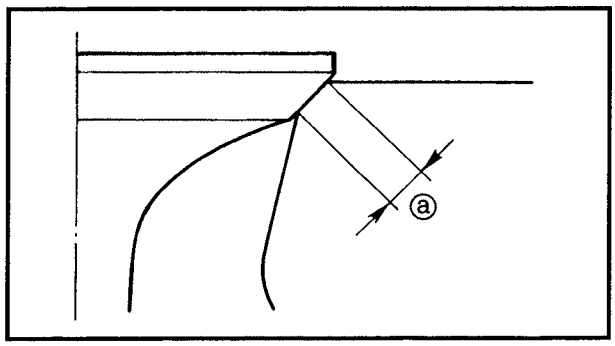
- Install the circlip and valve guide (new) using the valve guide installer and valve guide remover.

Valve guide installer:
YB-6308/90890-06802

- After installing the valve guide, bore the valve guide using the valve guide reamer ① to obtain proper stem-to-guide clearance.

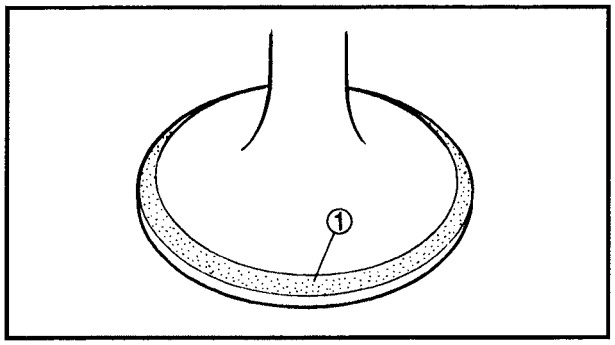
Valve guide reamer:
YM-1196/90890-06804

5. Eliminate:
   - Carbon deposit
     from valve face and valve seat.
6. Inspect:
   - Valve seat
     Wear/Pitting → Reface the valve seat.

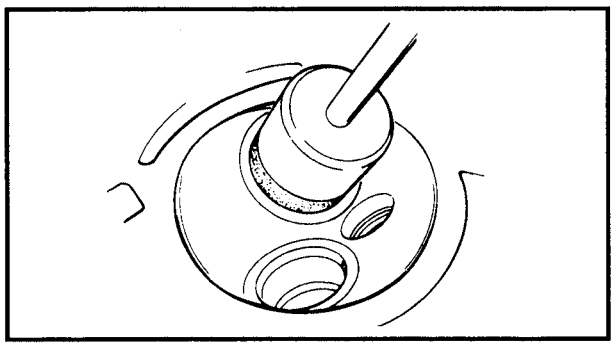


7. Measure:
   - Valve seat width ⓐ
     Out of specification → Resurface.

	Valve seat width:
IN EX	0.6 ~ 0.8 mm (0.024 ~ 0.031 in)



Measurement steps:
- Apply the Mechanic's bluing dye ① to the valve face.
- Install the valve into the cylinder head.
- Press the valve through the valve guide onto the valve seat to make a clear pattern.
- Measure the valve seat width. Wherever the valve seat and valve face made contact, bluing will have been removed.

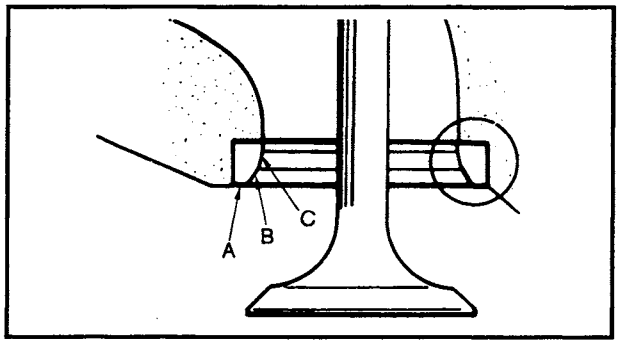


8. Reface:
   - Valve seat
     Use a 30°, 45° and 85° valve seat cutter.

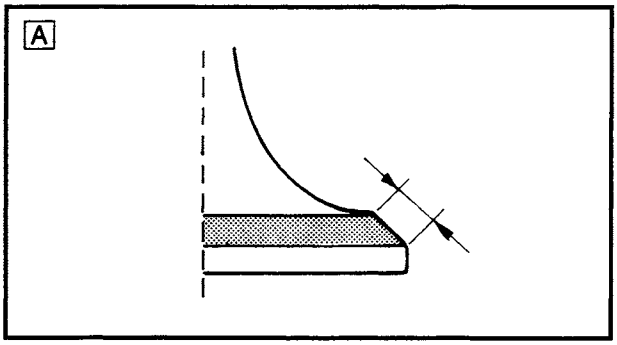
	Valve seat cutter set: YM-91043-C/90890-06803

CAUTION:

When twisting cutter, keep an even downward pressure (4 ~ 5 kg) to prevent chatter marks.



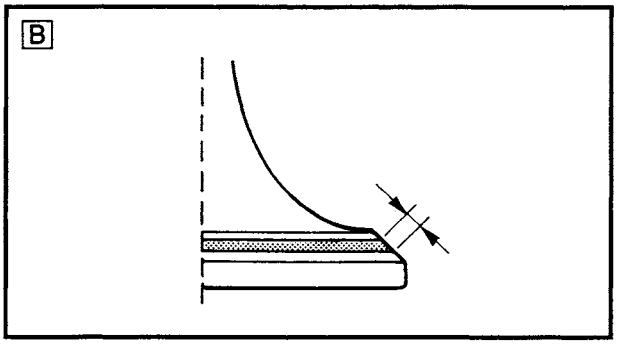
Cut sections as follows	
Section	**Cutter**
A	**85°**
B	**45°**
C	**30°**



Resurfacing steps:

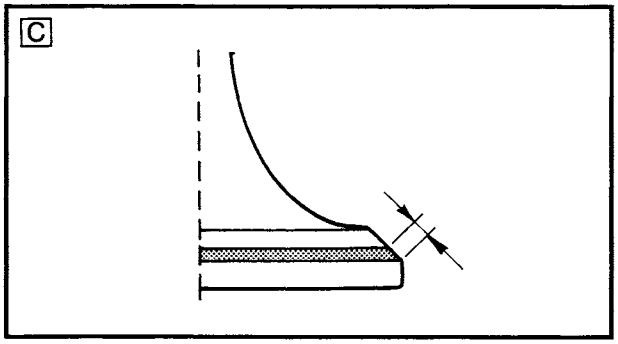
A Valve seat is centered on valve face but it is too wide.

Valve seat cutter set		Desired result
Use lightly	**85° cutter**	**To reduce valve seat width.**
	30° cutter	



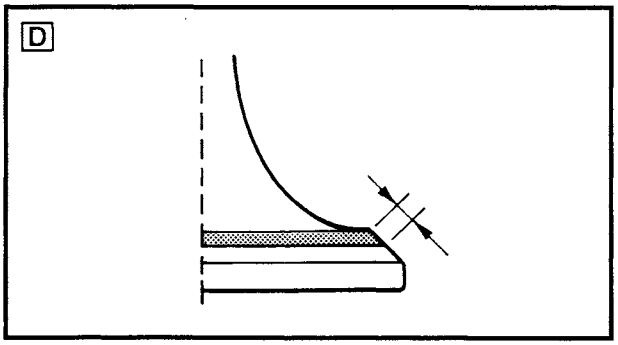
B Valve seat is in middle of the valve face but it is too narrow.

Valve seat cutter set		Desired result
Use	**45° cutter**	**To achieve a uniform valve seat width.**



C Valve seat is too narrow and it is near valve margin.

Valve seat cutter set		Desired result
Use	**85° cutter, first**	**To center the seat and to achieve its width.**
	45° cutter	

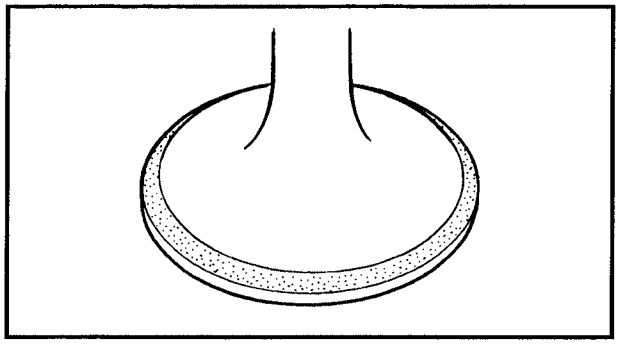


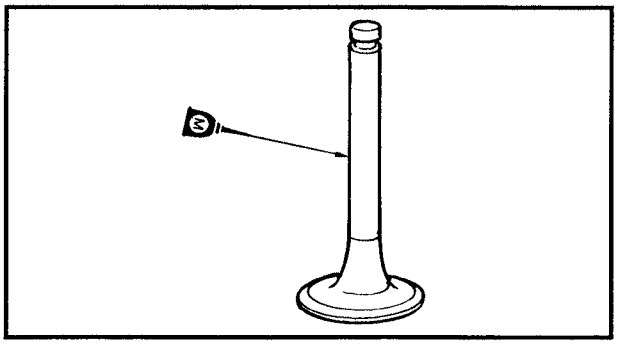
D Valve seat is too narrow and it is located near the bottom edge of the valve face.

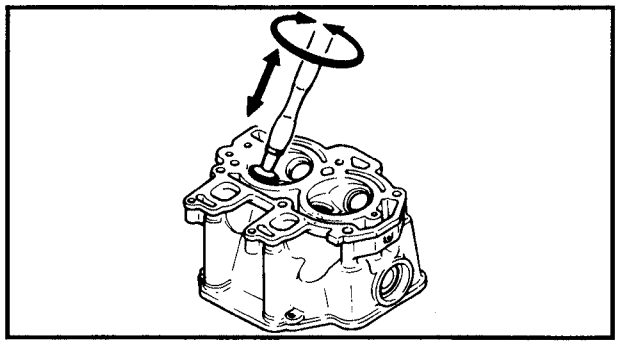
Valve seat cutter set		Desired result
Use	**30° cutter, first**	**To center the seat and to increase its width.**
	45° cutter	

9. Lap:
   - Valve face
   - Valve seat

NOTE:
After refacing the valve seat or replacing the valve and valve guide, the valve seat and valve face should be lapped.







Lapping steps:
- Apply a coarse lapping compound to the valve face.

CAUTION:
Be sure no compound enters the gap between the valve stem and guide.

- Apply a molybdenum disulfide oil to the valve stem.
- Install the valve into the cylinder head.
- Turn the valve until the valve face and valve seat are evenly polished, then clean off all compound.

NOTE:
To obtain the best lapping results, lightly tap the valve seat while rotating the valve back and forth between your hands.

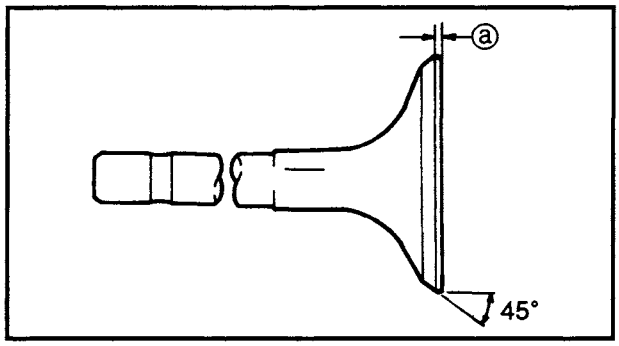
- Apply the fine lapping compound to the valve face and repeat the above steps.

NOTE:
Be sure to clean off all compound from the valve face and valve seat after every lapping operation.

- Apply the Mechanic's bluing dye to the valve face.
- Install the valve into the cylinder head.
- Press the valve through the valve guide and onto the valve seat to mark a clear pattern.
- Measure the valve seat width again. If the valve seat width is out of specification, reface and lap the valve seat.

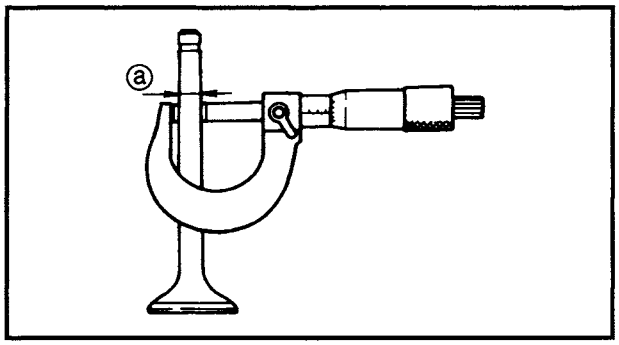
VALVE

1. Inspect:
   - Valve face
     Carbon deposits → Clean.
     Pitting/Wear → Grind the face.
   - Valve stem end
     Mushroom shape or diameter larger than rest of stem → Replace.



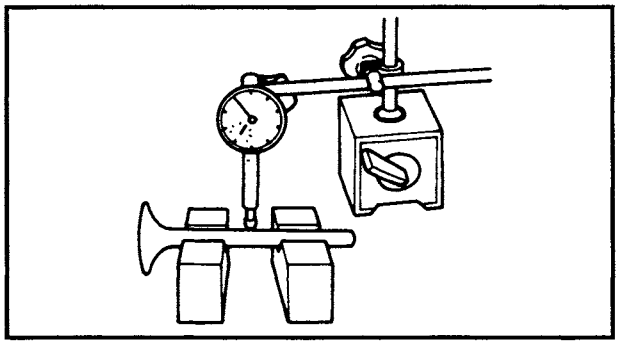
2. Measure:
   - Margin thickness ⓐ
     Out of specification → Replace.

	Margin thickness:
IN EX	0.5 ~ 0.9 mm (0.020 ~ 0.035 in)



3. Measure:
   - Valve stem diameter ⓐ
     Out of specification → Replace.

	Valve stem diameter:
IN	5.475 ~ 5.490 mm (0.2156 ~ 0.2161 in)
EX	5.460 ~ 5.475 mm (0.2150 ~ 0.2156 in)

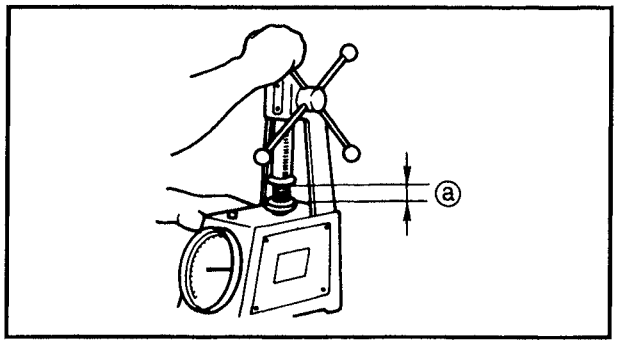


4. Measure:
   - Valve stem runout
     Out of specification → Replace.

	Stem runout limit:
IN EX	0.016 mm (0.0006 in)

NOTE:

- Always replace the guide if the valve is replaced.
- Always replace the oil seal if the valve is removed.

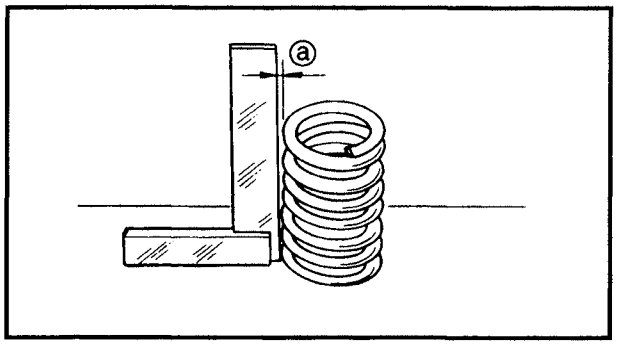


VALVE SPRING

1. Measure:
   - Compressed force

   Out of specification → Replace.

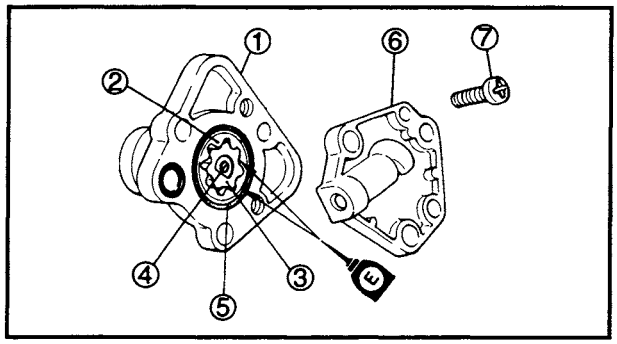
	Compressed force:	
IN EX	Set length ⓐ 24.4 mm (0.96 in)	90 ~ 100 N (9.0 ~ 10.0 kg, 19.8 ~ 22.0 lb)



2. Measure:
   - Spring tilt ⓐ

   Out of specification → Replace.

	Tilt limit:
IN EX	1.1 mm (0.043 in)



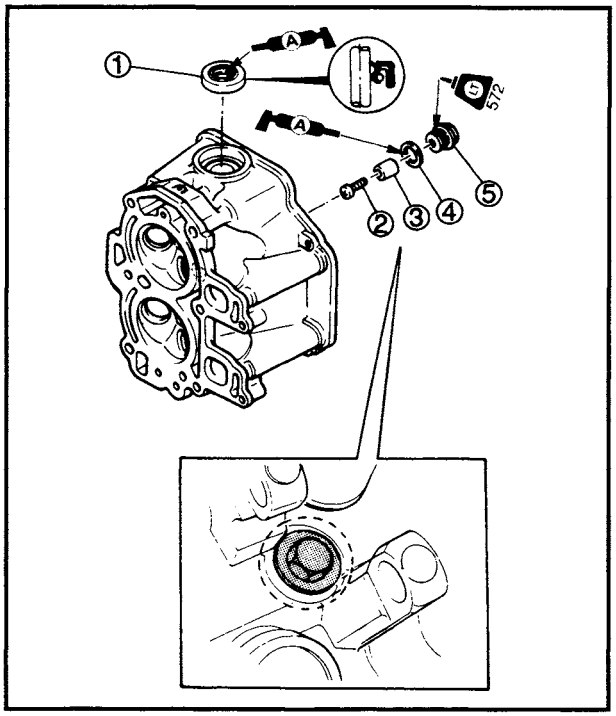
ASSEMBLY AND INSTALLATION

OIL PUMP ASSEMBLY

1. Install:
   - Pump housing ①
   - Outer rotor ②
   - Inner rotor ③
   - Shaft ④
   - O-ring ⑤
   - Pump cover ⑥
   - Screw ⑦

NOTE:

- Align the shaft with the hole in the inner rotor shaft and insert.
- Oil the rotors liberally before installing the pump cover.



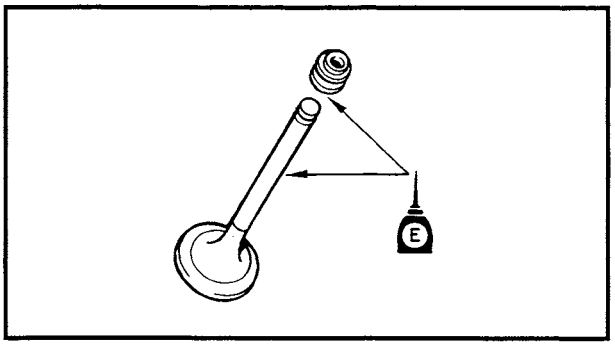
CYLINDER HEAD

1. Install:
   - Oil seal ①
   - Screw ②
   - Anode ③
   - O-ring ④
   - Bolt ⑤

NOTE:

Install the oil seal with its manufacture's marks or numbers facing outward.

	Bolt: **18 Nm (1.8 m • kg, 13 ft • lb)**

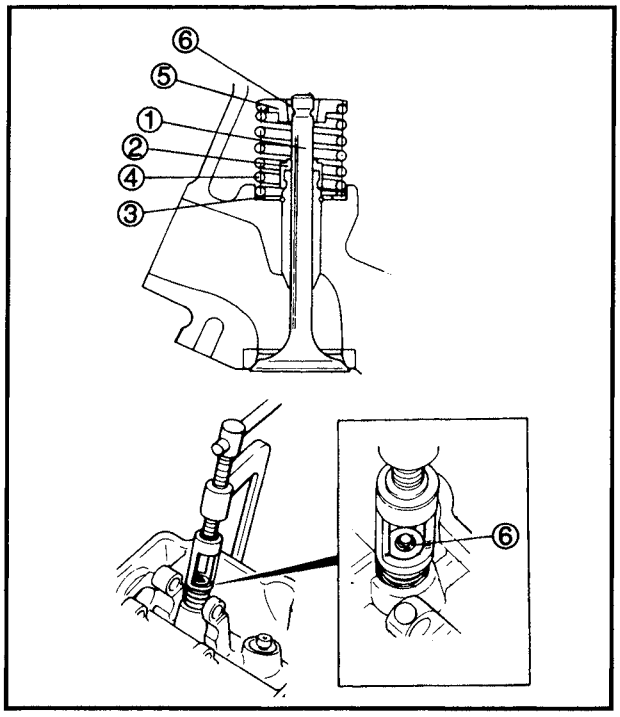


2. Apply:
   - Engine oil

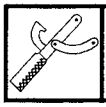
   Onto valve and oil seal.

NOTE:

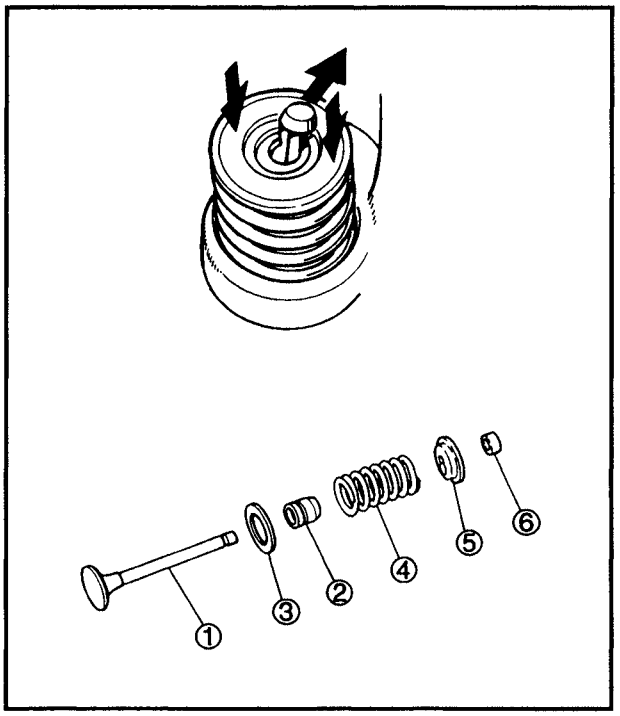
Always use a new oil seal.



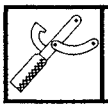
3. Install:
   - Valve (intake) ①
   - Oil seal ②
   - Spring seat ③
   - Valve spring ④
   - Spring retainer ⑤
   - Valve cotter ⑥

	**Valve spring compressor: YM-1253/90890-04019**

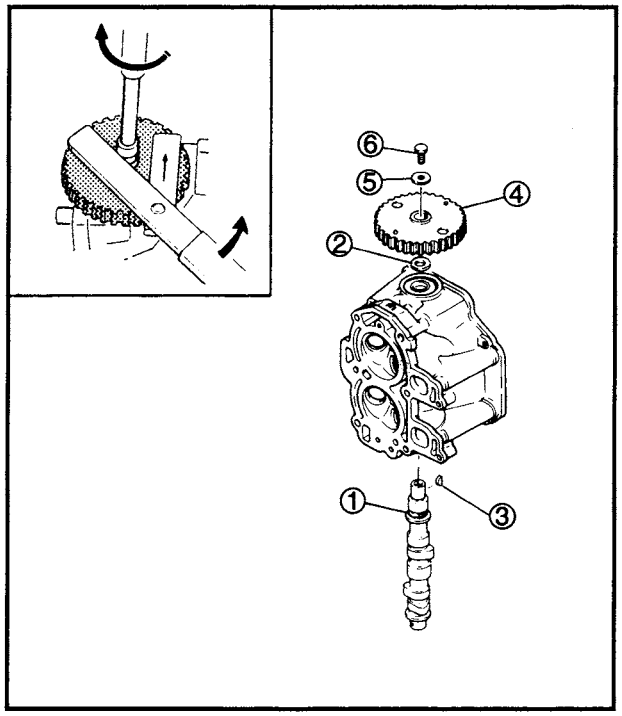
NOTE:
- Hold down the valve spring and install the valve cotter.
- Secure the valve cotter onto the valves stem by tapping it lightly with a piece of wood.



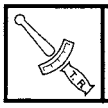
4. Install:
   - Valve (exhaust) ①
   - Oil seal ②
   - Spring seat ③
   - Valve spring ④
   - Spring retainer ⑤
   - Valve lifter ⑥

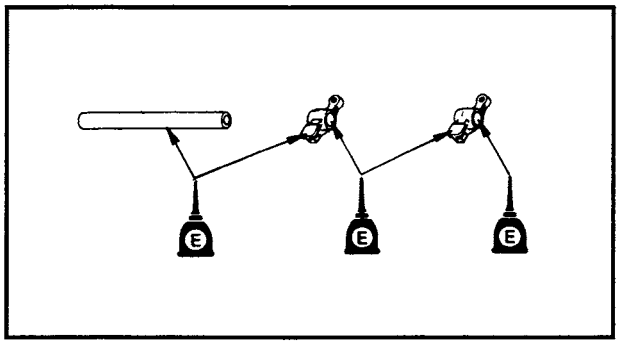
	**Valve spring compressor: YM-1253/90890-04019**

NOTE:
- Hold down the valve spring and install the spring retainer and slide in the retainer.
- Secure the valve lifter onto the valves stem by tapping it lightly with a piece of wood.



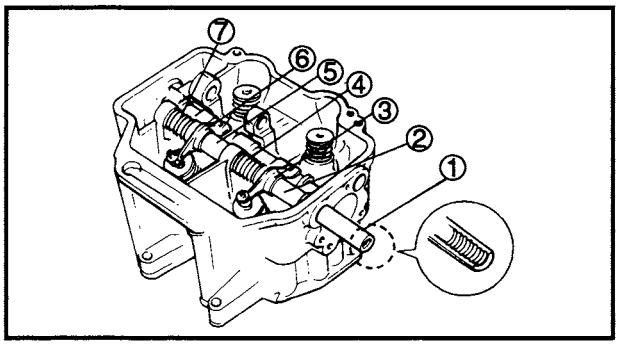
5. Install:
   - Camshaft ①
   - Washer ②
   - Woodruff key ③
   - Driven gear ④
   - Washer ⑤
   - Bolt ⑥

	Flywheel holder: **YB-6139/90890-06522**
	**Bolt:** **13 Nm (1.3 m • kg, 9.4 ft • lb)**



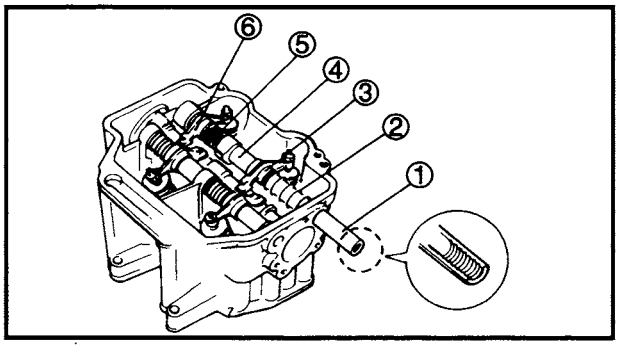
6. Apply:
   - Engine oil

   Onto rocker shaft and rocker arm.

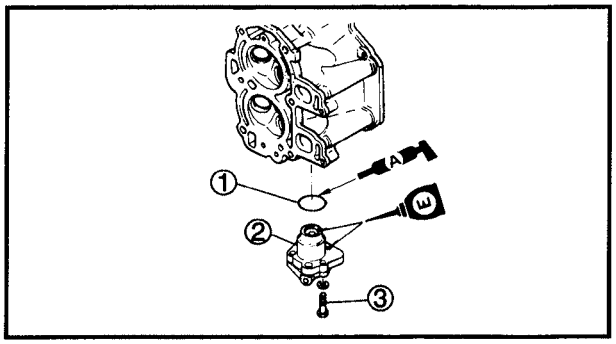


7. Install:
   - Rocker shaft (exhaust) ①
   - Collar ②
   - Rocker arm ③
   - Compression spring (short) ④
   - Collar ⑤
   - Rocker arm ⑥
   - Compression spring (short) ⑦

NOTE:
Install the rocker shaft so that the internal thread side is on your side.

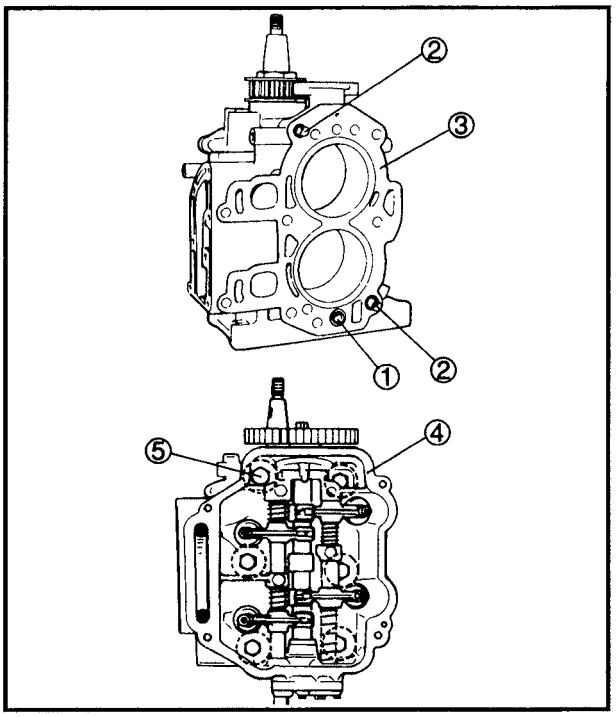


8. Install:
   - Rocker shaft (intake) ①
   - Compression spring (long) ②
   - Rocker arm ③
   - Collar ④
   - Compression spring (short) ⑤
   - Rocker arm ⑥



9. Install:
   - O-ring ①
   - Oil pump assembly ②
   - Bolt ③

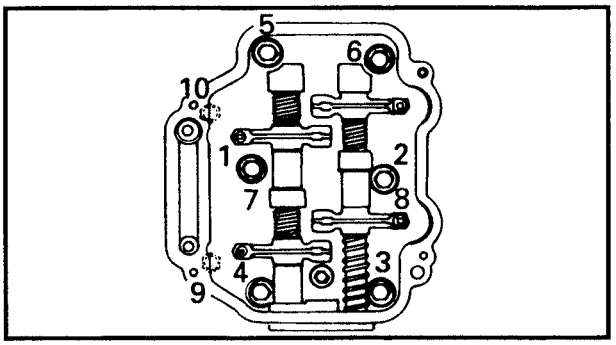
NOTE:
Align the recess in the oil pump shaft with the camshaft projection.



10. Install:
    - O-ring ①
    - Dowel pin ②
    - Gasket ③
    - Cylinder head assembly ④
    - Bolt ⑤

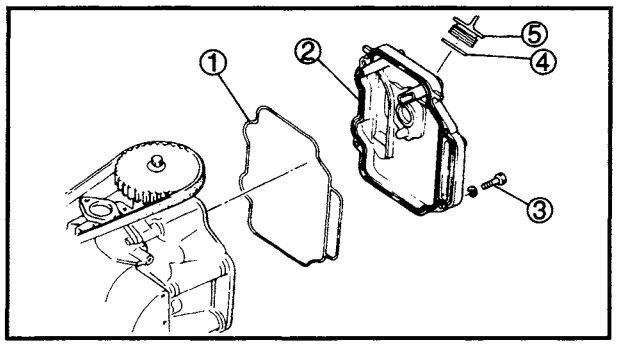
Bolt:
M8 1st:
15 Nm (1.5 m • kg, 11 ft • lb)
2nd:
30 Nm (3.0 m • kg, 22 ft • lb)

CAUTION:
When installing the cylinder head on the cylinder body, set the piston at bottom dead center (BDC); otherwise, the piston may butt against valves, thus damaging them.



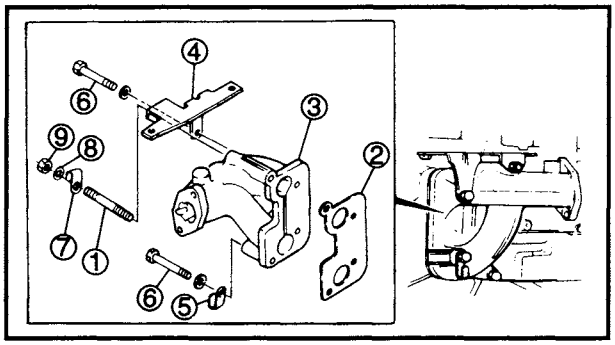
NOTE:
- Apply the engine oil to the thread of each cylinder head fixing bolt and seat surface.
- Tighten the bolts in sequence and two steps of torque.

11. Install:
    - Timing belt
      Refer to page 5-20.
12. Adjust:
    - Valve clearance
      Refer to page 3-8.



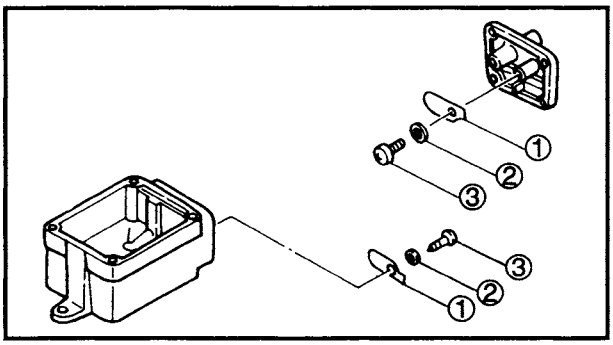
CYLINDER HEAD COVER

1. Install:
   - Seal ①
   - Cylinder head cover ②
   - Bolt ③
   - O-ring ④
   - Oil filler cap ⑤



INTAKE MANIFOLD

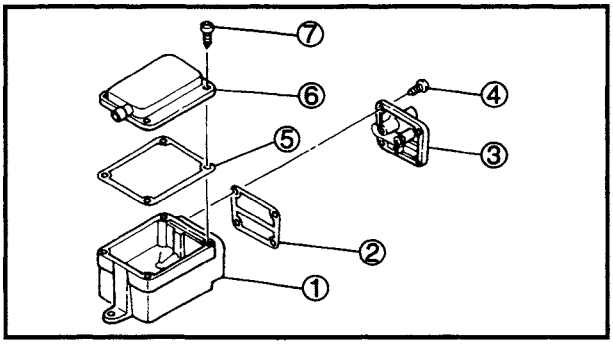
1. Install:
   - Stud bolt ①
   - Gasket ②
   - Intake manifold ③
   - Bracket ④
   - Clamp ⑤
   - Bolt ⑥
   - Clamp ⑦
   - Washer ⑧
   - Nut ⑨



OIL SEPARATOR

1. Install:
   - Reed valve ①
   - Washer ②
   - Screw ③

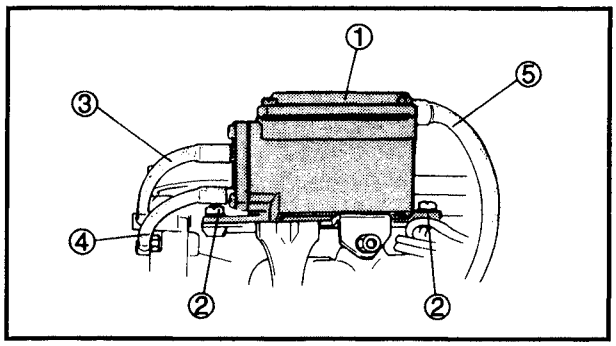
	Screw: **2 Nm (0.2 m • kg, 1.4 ft • lb)**



2. Install:
   - Oil separator body ①
   - Gasket ②
   - Breather ③
   - Screw ④
   - Gasket ⑤
   - Cover ⑥
   - Screw ⑦

NOTE:
Always use a new gasket.

	Screw: **2 Nm (0.2 m • kg, 1.4 ft • lb)**



3. Install:
   - Oil separator ①
   - Screw ②
   - Hose (long) ③
   - Hose (short) ④
   - Hose (breather) ⑤

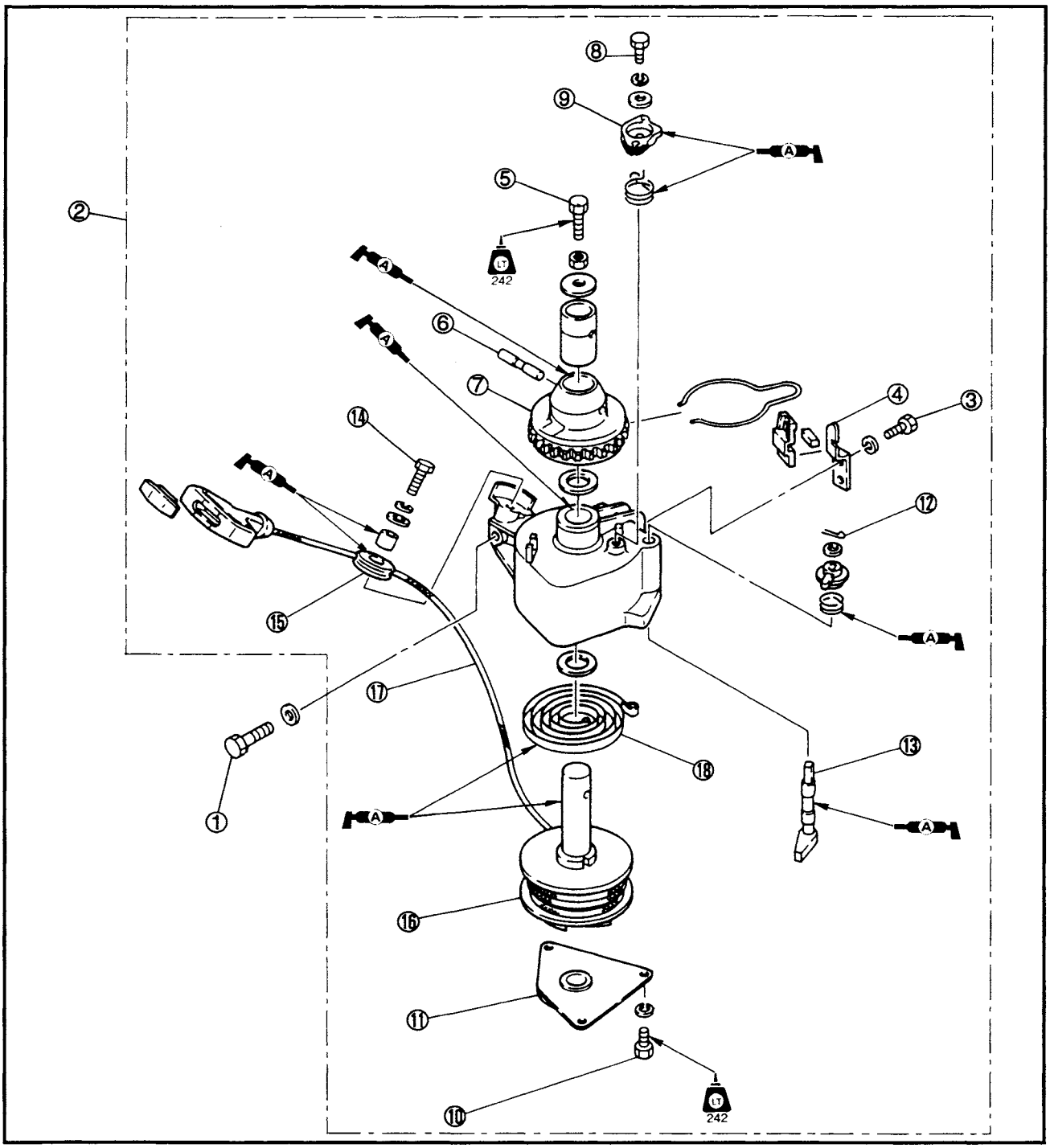
RECOIL STARTER

PREPARATION FOR REMOVAL

* Remove the power unit.
* Remove the flywheel magneto.

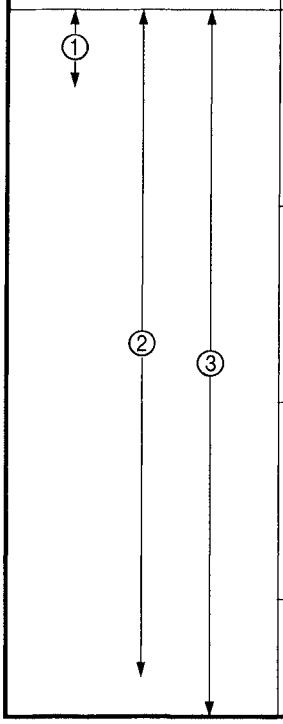
⚠ WARNING

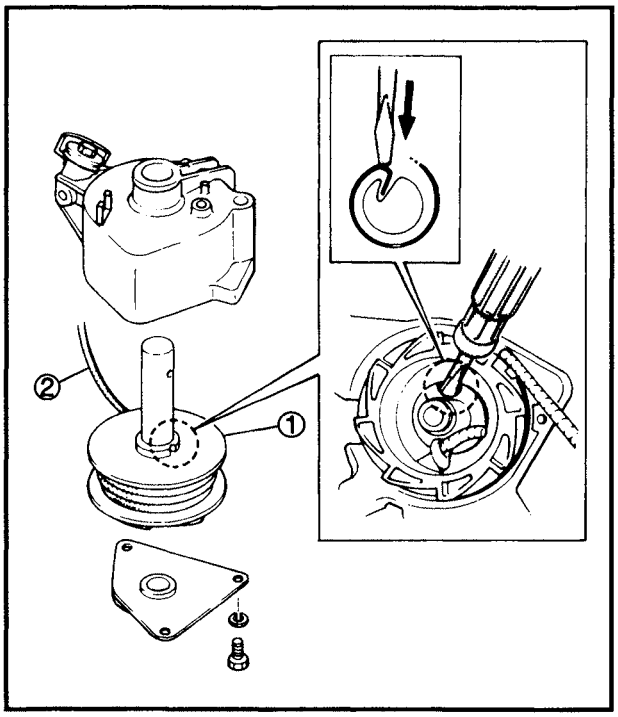
- **Wear a proper safety goggle and gloves for protecting your eyes and hands.**
- **Use care, the spiral jumps out and may injure a person.**
- **When removing the sheave drum, use care so that the spiral spring does not jump out.**



RECOIL STARTER

Extent of removal: ① Recoil starter removal ② Starter rope removal ③ Recoil starter disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
	1	Bolt	3	
	2	Recoil starter assembly	1	
	3	Bolt	2	
	4	Guide plate	1	
	5	Bolt	1	Loosen the lock nut.
	6	Pin	1	
	7	Pinion	1	
	8	Bolt	1	
	9	Stopper arm	1	
	10	Bolt	3	
	11	Cover	1	
	12	Cotter pin	1	
	13	Drum stopper	1	
	14	Bolt	1	
	15	Roller	1	
	16	Sheave drum	1	Refer to "REMOVAL POINTS".
	17	Starter rope	1	
	18	Spiral spring	1	Refer to "REMOVAL POINTS".



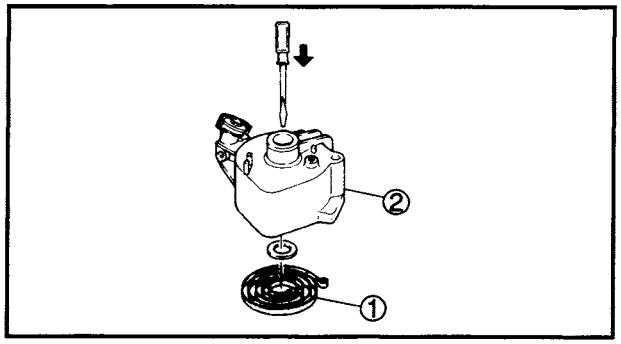
REMOVAL POINTS

STARTER ROPE

1. Remove:
   - Sheave drum ①
   - Starter rope ②

NOTE:

Insert a slotted-head screwdriver into the hole in the sheave drum and remove the spiral spring from the sheave drum by pushing the spring.



SPIRAL SPRING

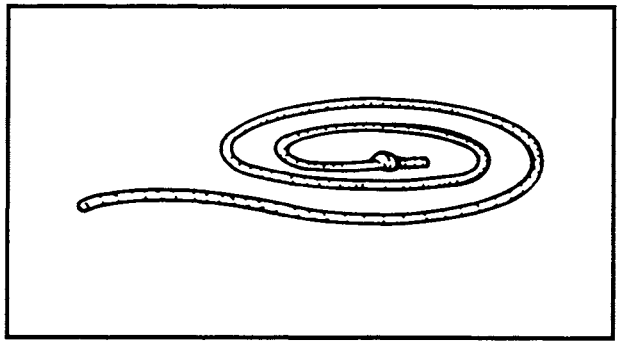
1. Remove:
   - Spiral spring ①

NOTE:

Hold the starter housing ② with the spiral spring facing downward. Insert a standard-head screw-driver into the hole in the sheave drum shaft and push the spiral spring out.

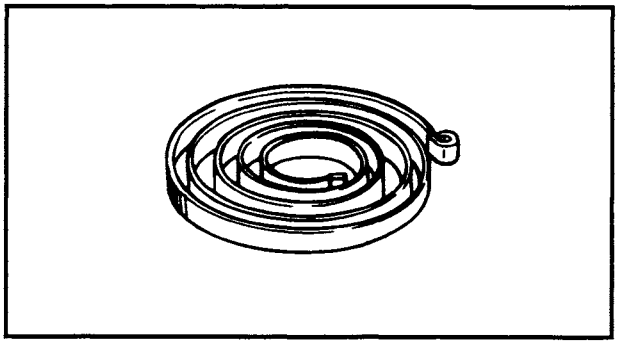
INSPECTION

STARTER ROPE



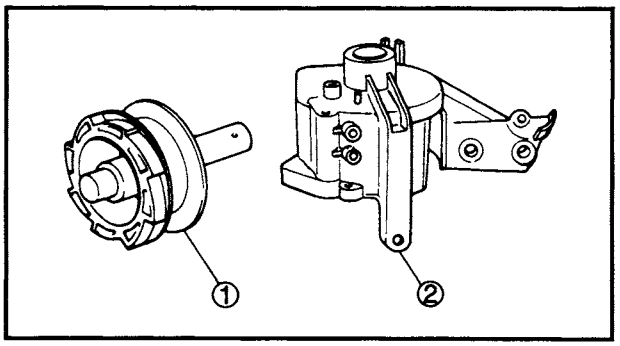
1. Inspect:
   - Starter rope
     Damage → Replace.

SPIRAL SPRING



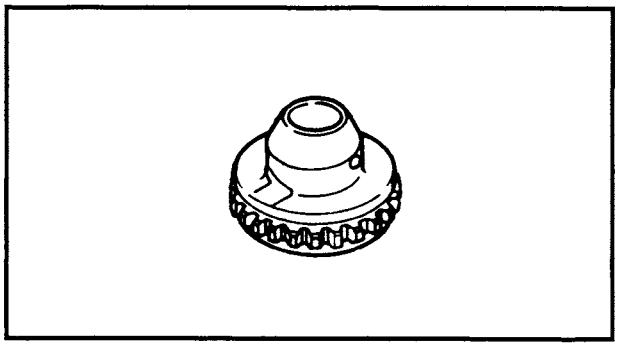
1. Inspect:
   - Spiral spring
     Wear/Damage → Replace.

SHEAVE DRUM AND STARTER HOUSING

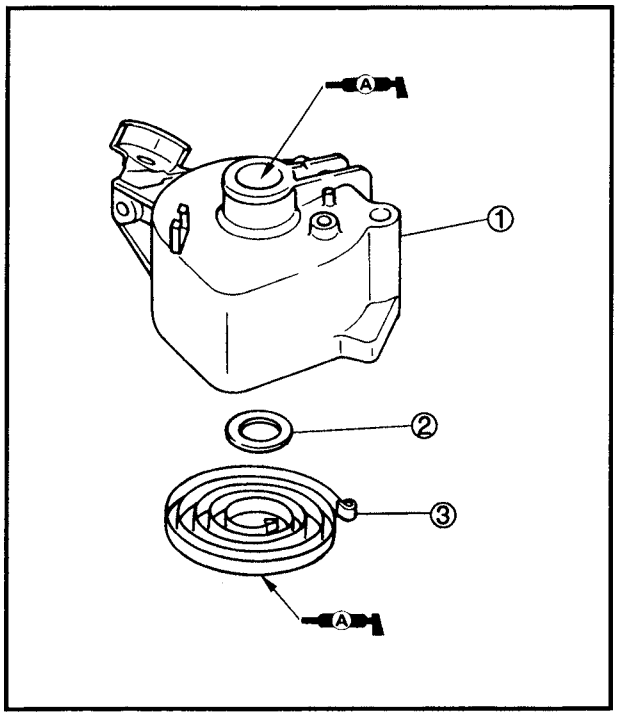


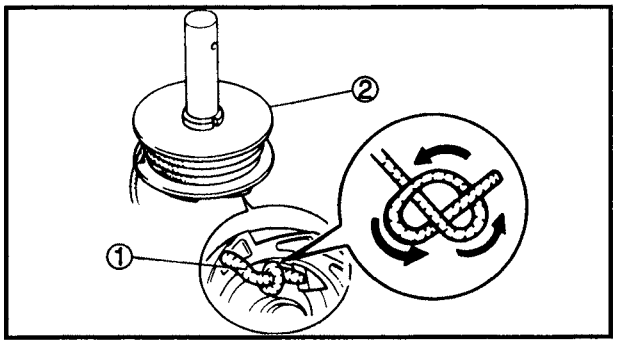
1. Inspect:
   - Sheave drum ①
   - Starter housing ②
     Damage → Replace.

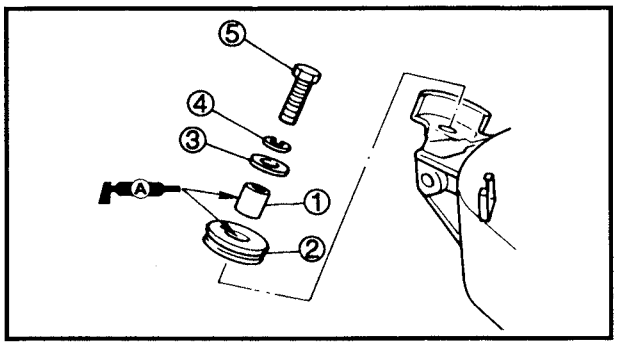
PINION

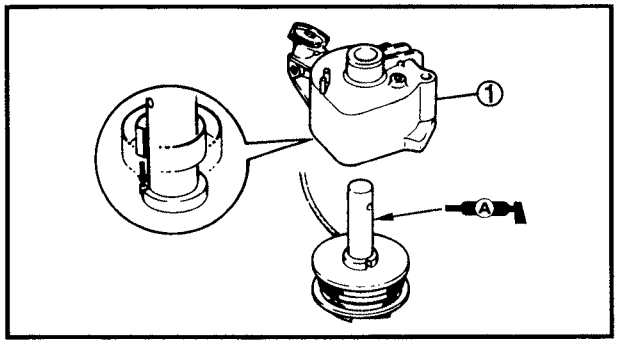


1. Inspect:
   - Pinion
     Damage → Replace.









ASSEMBLY AND INSTALLATION

1. Install:
   - Starter housing ①
   - Thrust washer ②
   - Spiral spring ③

NOTE:

1. After installing the new spiral spring, cut the wire holding the spring.
2. When reusing the spiral spring, set the leading end first in the housing and then fit one turn each time. Use special care. The spring can easily come off.

⚠ WARNING

The spiral spring may jump out so use special care.

2. Install:
   - Starter rope ①
   - Sheave drum ②

NOTE:

- Make a knot on one end.
- Pass the rope through the hole in the sheave drum and wind it 5.5 turns around the drum.
- Place the rope in the recess on the drum.

3. Install:
   - Bushing ①
   - Roller ②
   - Washer ③
   - Spring washer ④
   - Bolt ⑤

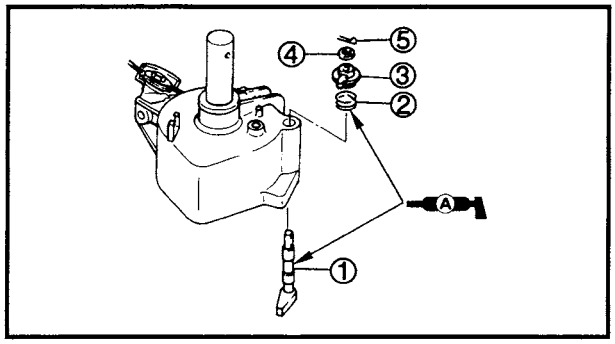
NOTE:

After installing, route the starter rope between the starter roller and starter housing.

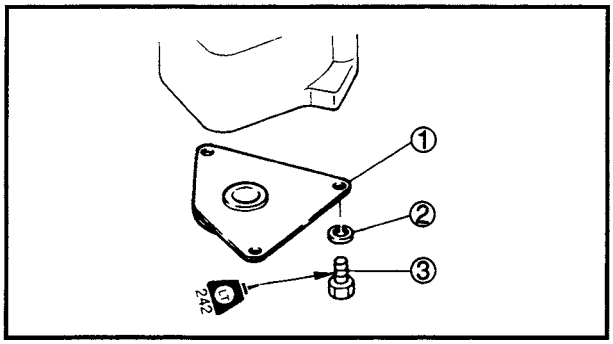
4. Install:
   - Starter housing ①

NOTE:

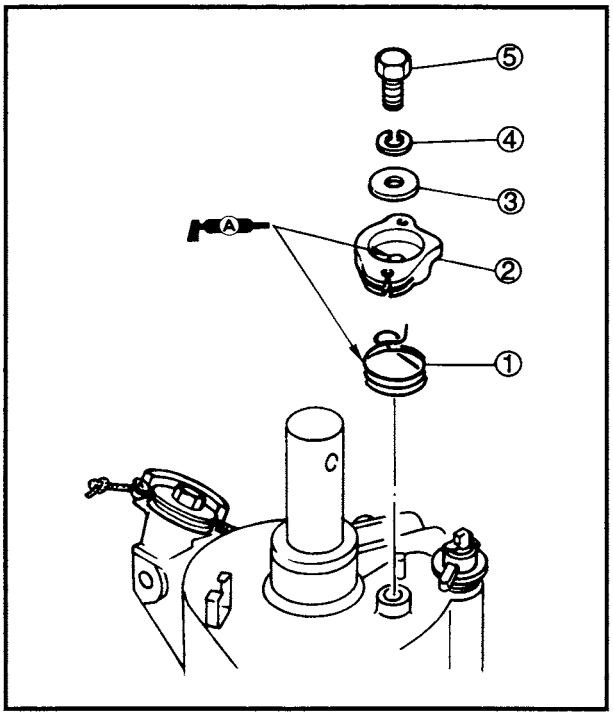
Fit the spiral spring hook into the sheave drum groove.



5. Install:
   - Drum stopper ①
   - Stopper spring ②
   - Collar ③
   - Washer ④
   - Cotter pin ⑤



6. Install:
   - Cover ①
   - Spring washer ②
   - Bolt ③



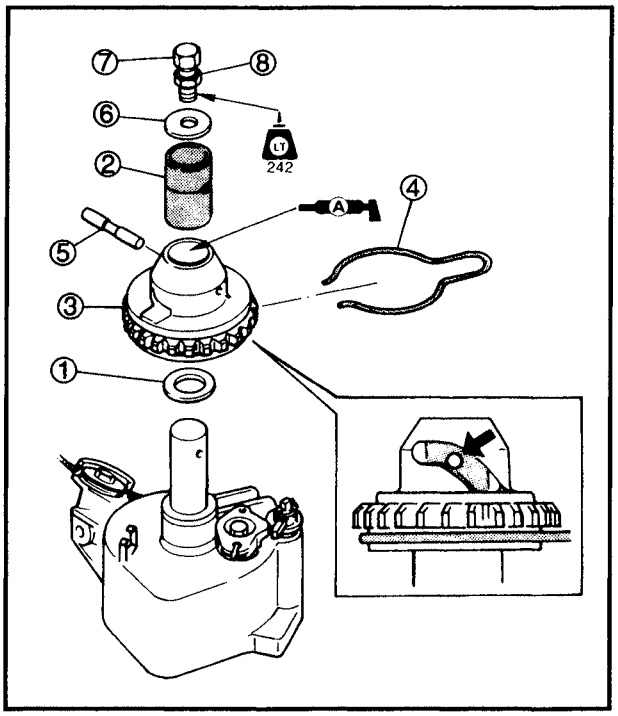
7. Install:
   - Arm spring ①
   - Stopper arm ②
   - Washer ③
   - Spring washer ④
   - Bolt ⑤

CAUTION:

Firmly hold the rope or the rope will be pulled in.

NOTE:

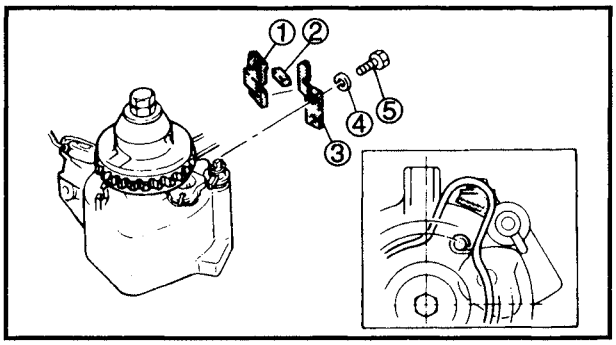
- Hook the spring onto the starter housing and stopper arm.
- Align the arrow marks on the collar and stopper arm.
- After assembling, wind the rope 4 turns clock-wise around the sheave drum to contract the spring.
- While holding the rope firmly, tie the rope temporarily to the starter roller.



8. Install:
   - Washer ①
   - Bushing ②
   - Pinion ③
   - Friction spring ④
   - Pin ⑤
   - Washer ⑥
   - Bolt ⑦
   - Lock nut ⑧

CAUTION:

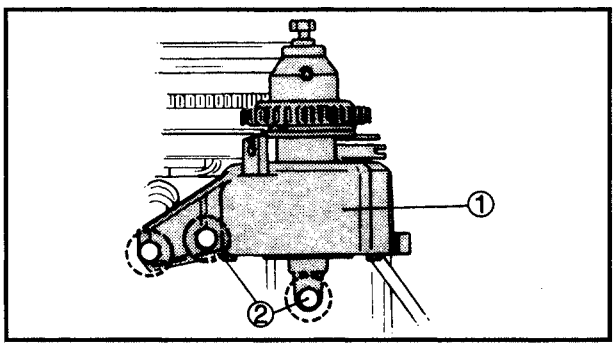
Do not open the spring end gap to fit it or the gap will become large, thus making the spring unusable. It should be fit in the same manner as a piston ring.



9. Install:
   - Protector ①
   - Damper ②
   - Guide plate ③
   - Spring washer ④
   - Bolt ⑤

NOTE:

Put the protector into the loop of the friction spring.



10. Install:
    - Recoil starter assembly ①
    - Bolt ②
11. Install:
    - Start in-gear protection wire
      Refer to page 5-4.

CHAPTER 6
LOWER UNIT

LOWER UNIT 6-1
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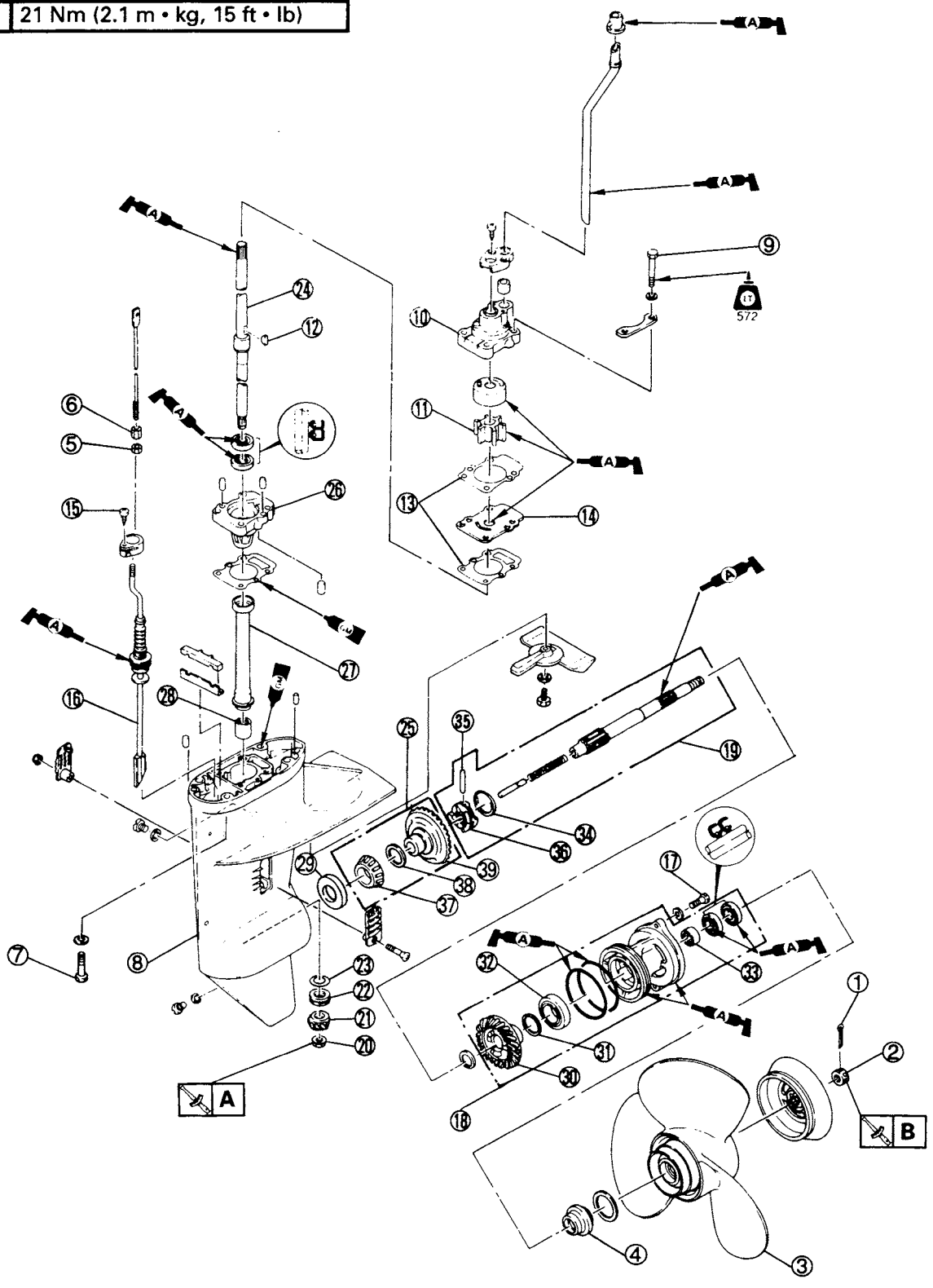
LOWER UNIT

PREPARATION FOR REMOVAL (T9.9/FT9.9A)

* Drain the gear oil.

A	26 Nm (2.6 m • kg, 19 ft • lb)
B	21 Nm (2.1 m • kg, 15 ft • lb)



NOTE ON REMOVAL AND REASSEMBLY

- Tilt up the engine a little, this provides easier oil draining.
- Remove any gasket adhered to the contacting surface.
- The shim pack will be reused; therefore, use care not to damage when removing.
- For reassembly, the removed parts should be cleaned with solvent.

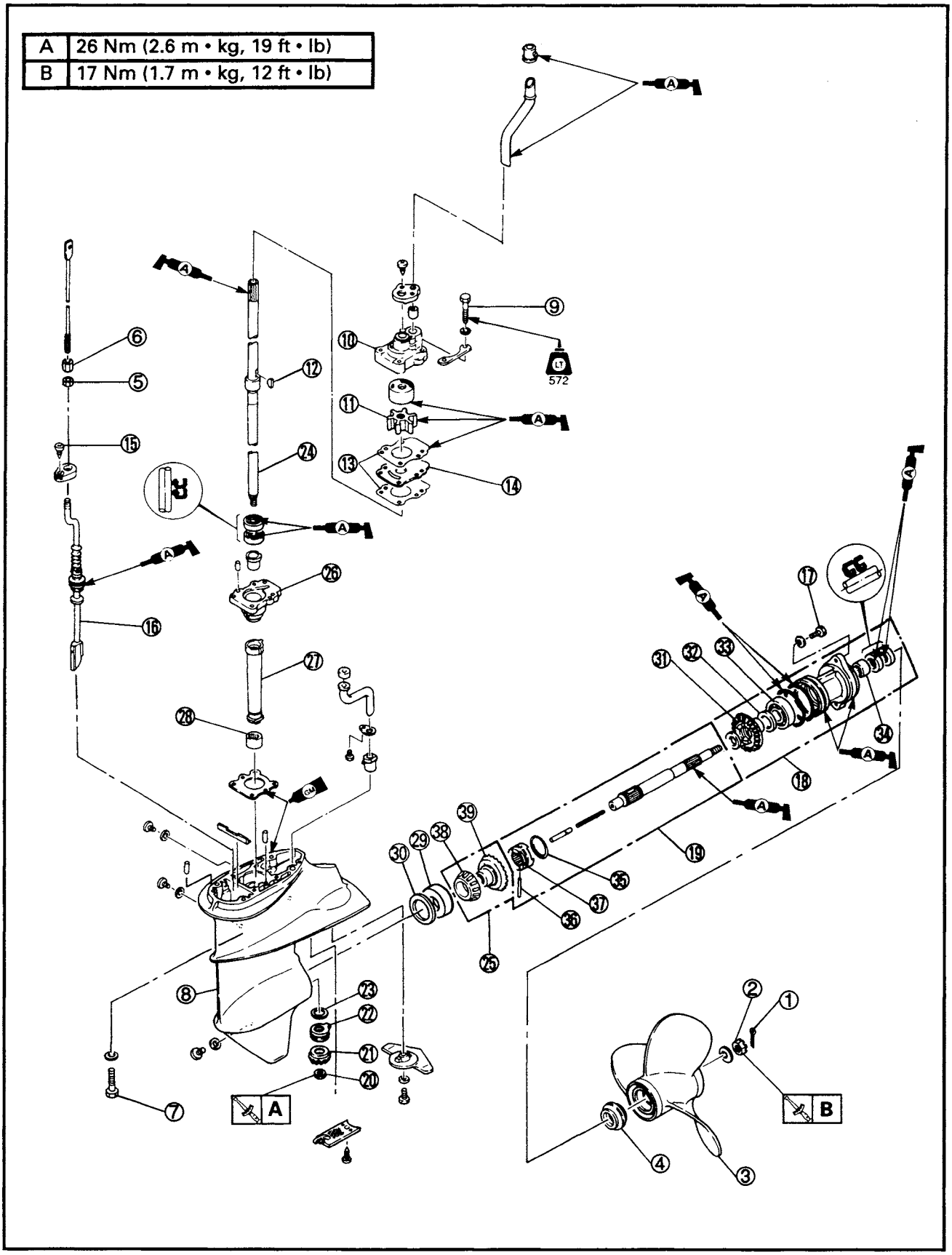
Extent of removal: ① Lower unit removal ② Impeller remove ③ Lower unit disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
① ② ③	1	Cotter pin	1	
	2	Nut	1	
	3	Propeller	1	
	4	Spacer	1	
	5	Lock nut	1	
② ③	6	Nut	1	
	7	Bolt	4	
	8	Lower unit	1	
	9	Bolt	4	
	10	Water pump housing	1	
② ③	11	Impeller	1	
	12	Woodruff key	1	
	13	Gasket	2	
	14	Outer plate	1	
	15	Screw	1	
③	16	Shift shaft	1	Refer to "REMOVAL POINTS".
	17	Bolt	2	
	18	Reverse gear complete	1	Refer to "REMOVAL POINTS".
	19	Propeller shaft complete	1	
	20	Nut	1	Refer to "REMOVAL POINTS".
	21	Pinion gear	1	
	22	Thrust bearing	1	
	23	Pinion gear shim	1	
	24	Drive shaft	1	
	25	Forward gear complete	1	
	26	Oil seal housing	1	
	27	Sleeve	1	
	28	Needle bearing	1	Refer to "REMOVAL POINTS".
	29	Bearing outer race	1	Refer to "REMOVAL POINTS".
	30	Reverse gear	1	
	31	Reverse gear shim	1	
	32	Ball bearing	1	Refer to "REMOVAL POINTS".
	33	Needle bearing	1	
	34	Cross pin ring	1	
	35	Cross pin	1	
	36	Dog clutch	1	
	37	Taper roller bearing	1	
	38	Forward gear shim	1	
	39	Forward gear	1	

PREPARATION FOR REMOVAL (F8B, F9.9/F9.9B)

* Drain the gear oil.

A	26 Nm (2.6 m • kg, 19 ft • lb)
B	17 Nm (1.7 m • kg, 12 ft • lb)

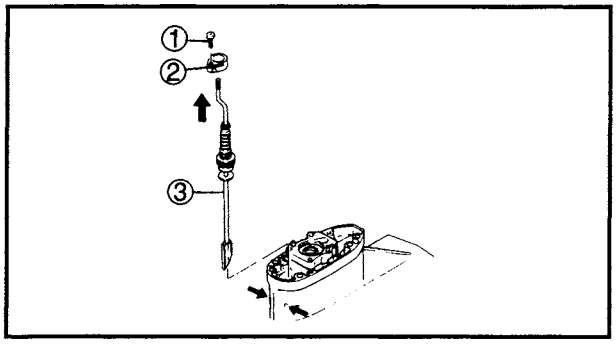


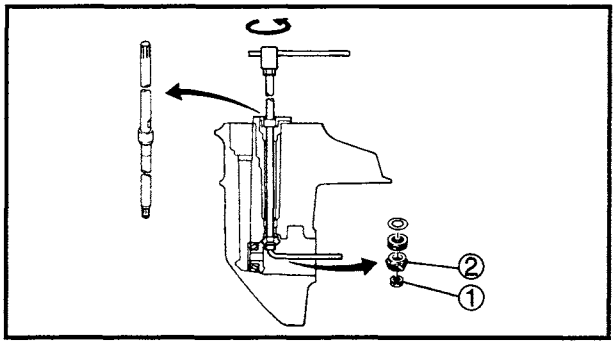
NOTE ON REMOVAL AND REASSEMBLY

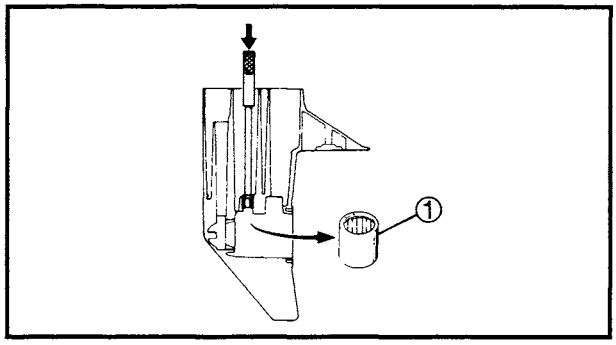
- Tilt up the engine a little, this provides easier oil draining.
- Remove any gasket adhered to the contacting surface.
- The shim pack will be reused; therefore, use care not to damage when removing.
- For reassembly, the removed parts should be cleaned with solvent.

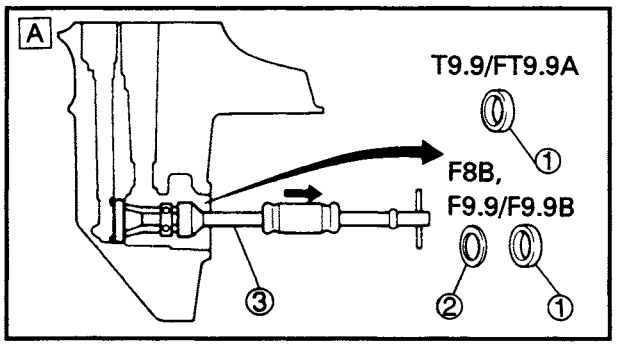
Extent of removal: ① Lower unit removal ② Impeller remove ③ Lower unit disassembly

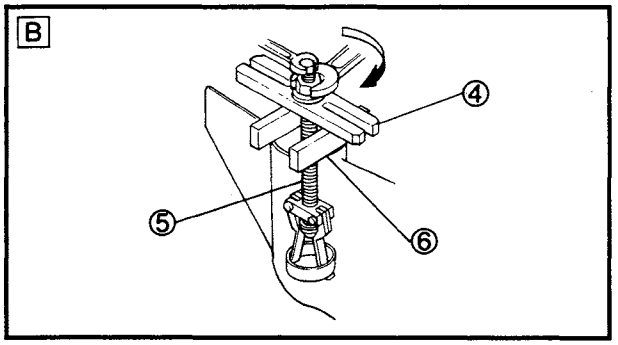
Extent of removal	Order	Part name	Q'ty	Remarks
① ② ③	1	Cotter pin	1	
	2	Nut	1	
	3	Propeller	1	
	4	Spacer	1	
	5	Lock nut	1	
② ③	6	Nut	1	
	7	Bolt	4	
	8	Lower unit	1	
	9	Bolt	4	
	10	Water pump housing	1	
	11	Impeller	1	
	12	Woodruff key	1	
	13	Gasket	2	
	14	Outer plate	1	
	15	Screw	1	
③	16	Shift shaft	1	Refer to "REMOVAL POINTS".
	17	Bolt	2	
	18	Reverse gear complete	1	Refer to "REMOVAL POINTS".
	19	Propeller shaft complete	1	
	20	Nut	1	Refer to "REMOVAL POINTS".
	21	Pinion gear	1	
	22	Thrust bearing	1	
	23	Pinion gear shim	1	
	24	Drive shaft	1	
	25	Forward gear complete	1	
	26	Oil seal housing	1	
	27	Sleeve	1	
	28	Needle bearing	1	Refer to "REMOVAL POINTS".
	29	Bearing outer race	1	Refer to "REMOVAL POINTS".
	30	Forward gear shim	1	
	31	Reverse gear	1	
	32	Reverse gear shim	1	
	33	Ball bearing	1	Refer to "REMOVAL POINTS".
	34	Needle bearing	1	
	35	Cross pin ring	1	
	36	Cross pin	1	
	37	Dog clutch	1	
	38	Taper roller bearing	1	
	39	Forward gear	1	Refer to "REMOVAL POINTS".











REMOVAL POINTS

SHIFT SHAFT

1. Remove:
   - Screw ①
   - Bracket ②
   - Shift shaft ③

NOTE:

Push the projections of the bracket evenly (as shown in the illustration) and pull the bracket up.

PINION GEAR

1. Remove:
   - Nut ①
   - Pinion gear ②

Pinion nut holder:
YB-6078
Drive shaft holder:
YB-6228/90890-06515

NEEDLE BEARING

1. Remove:
   - Needle bearing ①

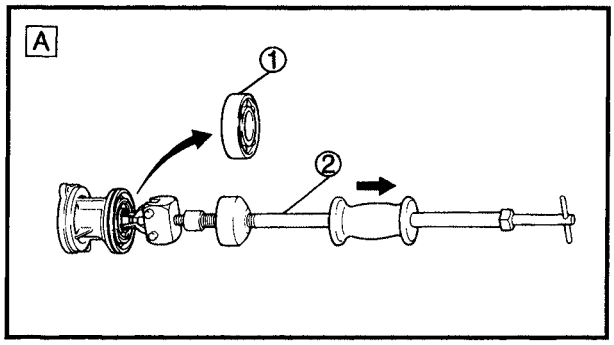
Drive rod:
YB-6229/90890-06602
Needle bearing attachment:
T9.9/FT9.9A:
YB-6298/90890-06618
F9.9/F9.9B:
YB-6230/90890-06617

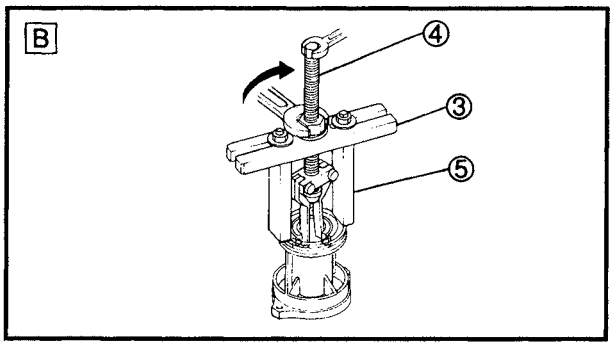
BEARING OUTER RACE

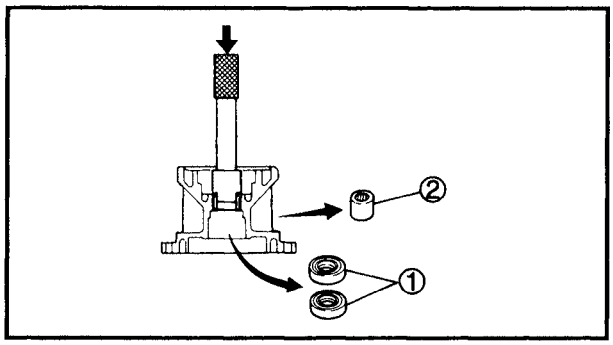
1. Remove:
   - Bearing outer race ①
   - Forward gear shim (F8B, F9.9/F9.9B only) ②

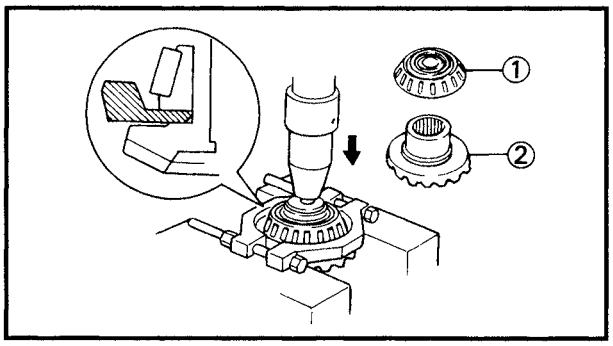
Slide hammer set:
YB-6096 ..... ③
Stopper guide plate:
90890-06501 ..... ④
Bearing puller:
90890-06535 ..... ⑤
Stopper guide stand:
90890-06538 ..... ⑥

A For USA and CANADA
B Except for USA and CANADA









REVERSE GEAR COMPLETE

1. Remove:
   - Ball bearing ①

	Slide hammer set:
	YB-6096 ..... ②
	Stopper guide plate:
	90890-06501 ..... ③
	Bearing puller:
	90890-06535 ..... ④
	Stopper guide stand:
	90890-06538 ..... ⑤

A For USA and CANADA
B Except for USA and CANADA

2. Remove:
   - Oil seal ①
   - Needle bearing ②

	Drive rod:
	YB-6071/90890-06604
	Needle bearing attachment:
	YB-6081/90890-06616

FORWARD GEAR COMPLETE
(F8B, F9.9/F9.9B)

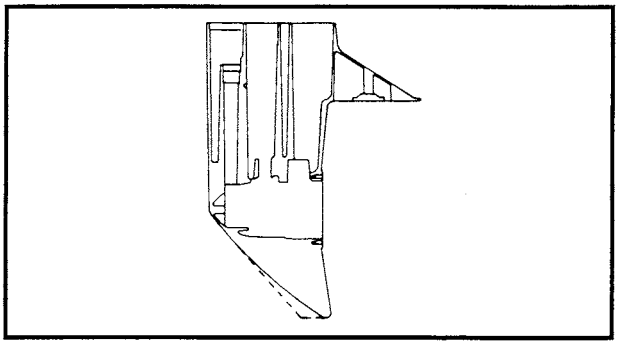
1. Remove:
   - Taper roller bearing ①
   - Forward gear ②

	Bearing separator:
	YB-6219/90890-06534

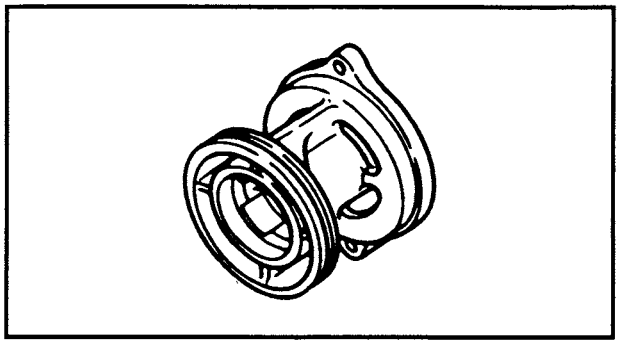
INSPECTION AND REPAIR

LOWER CASE

1. Clean:
   - Gear case
     Use a soft brush and solvent.
2. Inspect:
   - Water passage
     Mineral deposits/Corrosion → Clean.

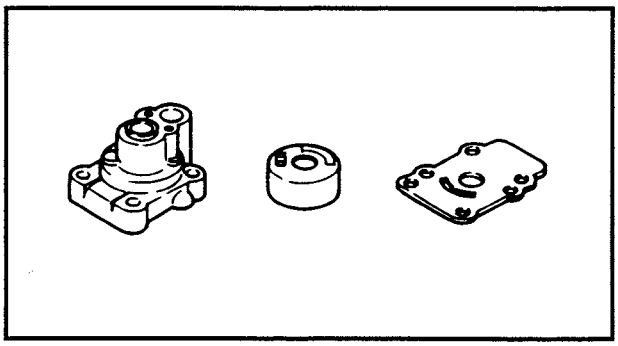


3. Inspect:
   - Lower case
     Crack/Damage → Replace.



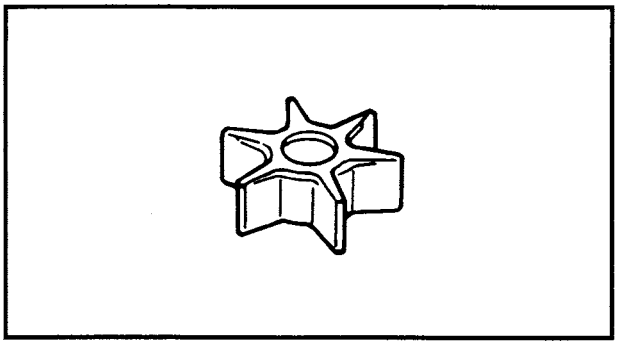
BEARING HOUSING

1. Clean:
   - Bearing housing
     Use a soft brush and solvent.
2. Inspect:
   - Bearing housing
     Crack/Damage → Replace.



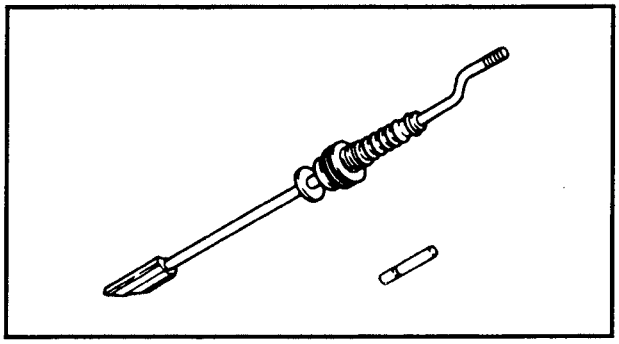
WATER PUMP HOUSING

1. Inspect:
   - Water pump housing
     Crack/Damage → Replace.



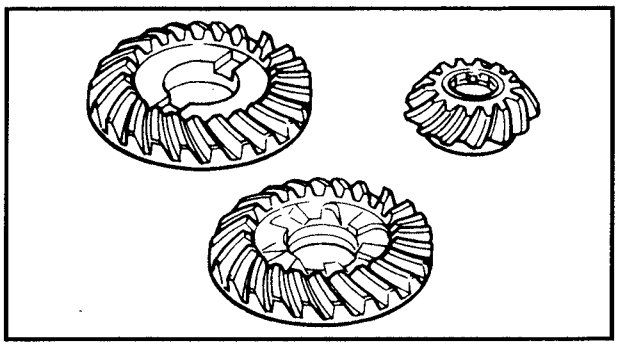
IMPELLER

1. Inspect:
   - Impeller
     Crack/Damage → Replace.



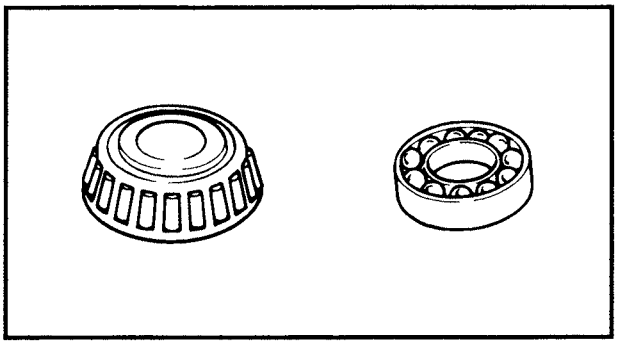
SHIFT SHAFT

1. Inspect:
   - Shift plunger
     Wear/Damage → Replace.
2. Inspect:
   - Boot
     Break/Damage → Replace.



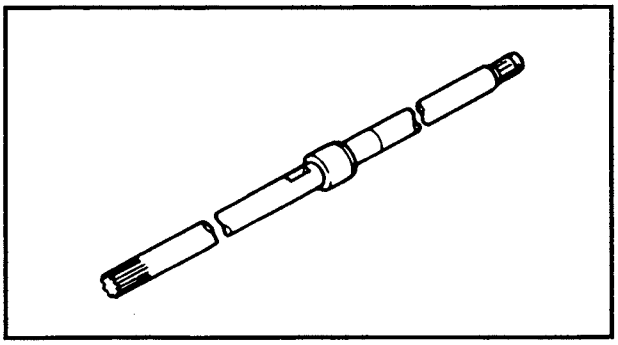
GEAR

1. Inspect:
   - Teeth
   - Dogs
     Wear/Damage → Replace.



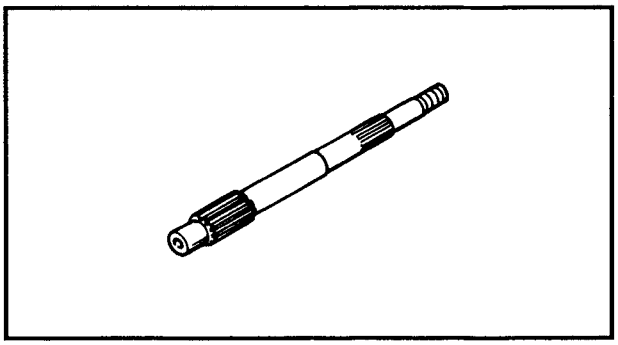
BEARING

1. Inspect:
   - Bearing
     Pitting/Rumbling → Replace.



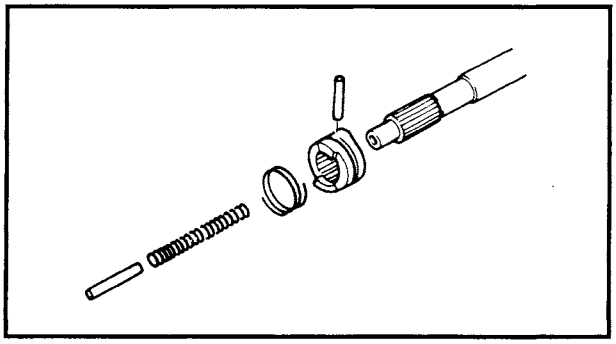
DRIVE SHAFT

1. Inspect:
   - Drive shaft
     Wear/Damage → Replace.



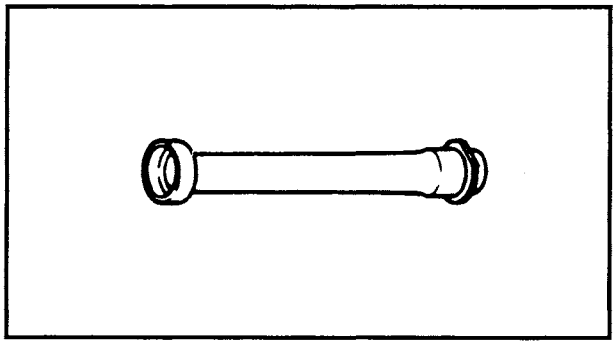
PROPELLER SHAFT

1. Inspect:
   - Propeller shaft
     Wear/Damage → Replace.



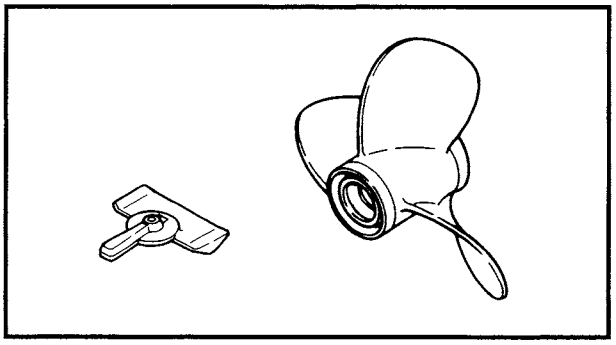
DOG CLUTCH

1. Inspect:
   - Dog clutch
     Wear/Damage → Replace.



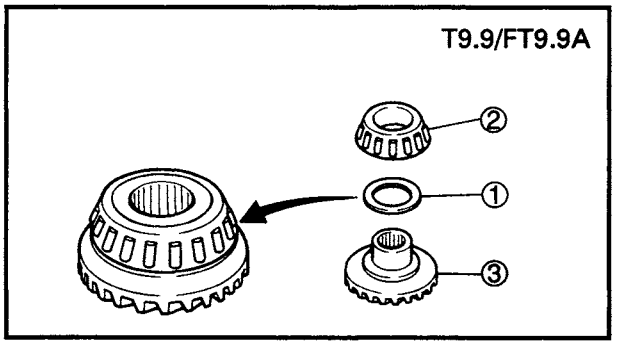
SLEEVE

1. Inspect:
   - Sleeve
     Wear/Damage → Replace.



PROPELLER/ANODE

Refer to pages 3-1 ~ 3-2.

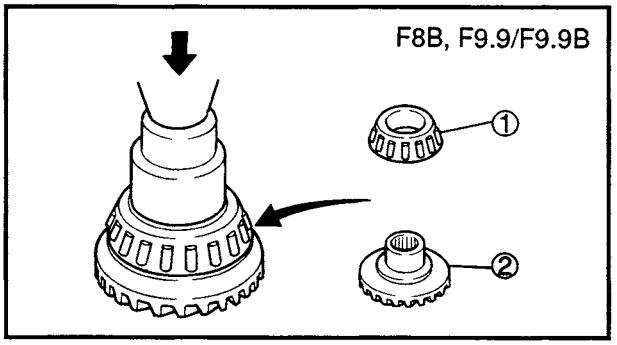


ASSEMBLY AND INSTALLATION

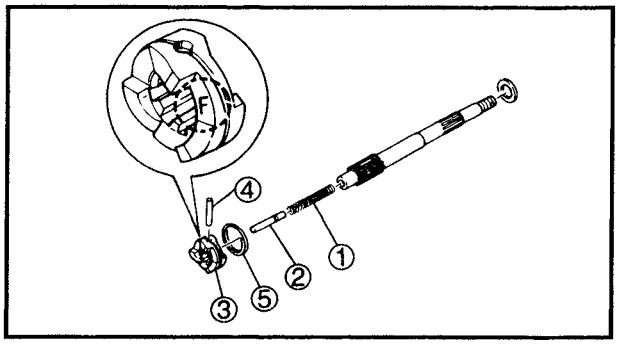
FORWARD GEAR

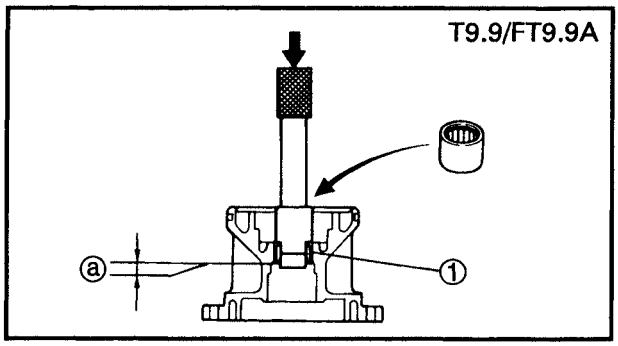
1. Install: (T9.9/FT9.9A)
   - Forward gear shim ①
   - Taper roller bearing ②
   - Forward gear ③

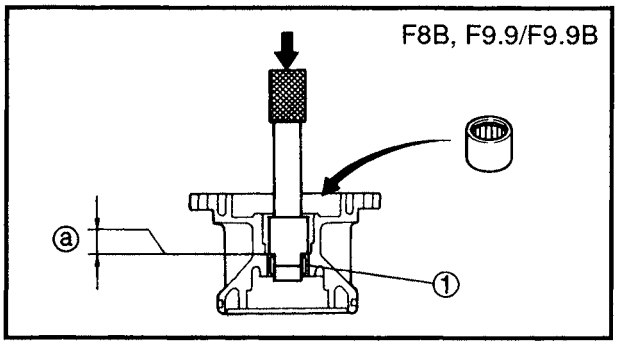
NOTE:
The shim is installed for T9.9/FT9.9A model only.

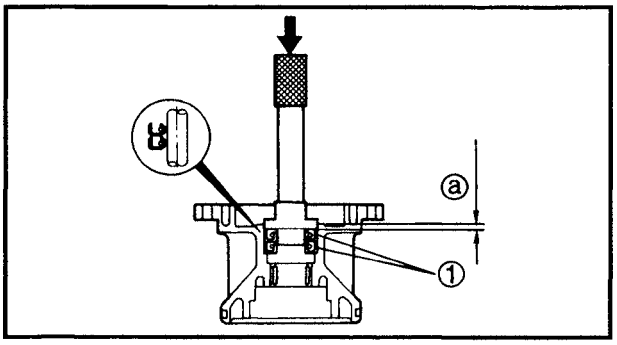


1. Install: (F8B, F9.9/F9.9B)
   - Taper roller bearing ①
   - Forward gear ②









PROPELLER SHAFT

1. Install:
   - Spring ①
   - Plunger ②
   - Dog clutch ③
   - Cross pin ④
   - Cross pin ring ⑤

NOTE:

Install the clutch with the "F" mark toward the forward gear side.

REVERSE GEAR

1. Install:
   - Needle bearing ①

Drive rod:
YB-6071/90890-06604
Needle bearing attachment:
YB-6081/90890-06616

Depth ⓐ:
T9.9/FT9.9A: 0 mm (0 in)
F8B, F9.9/F9.9B: 0 mm (0 in)

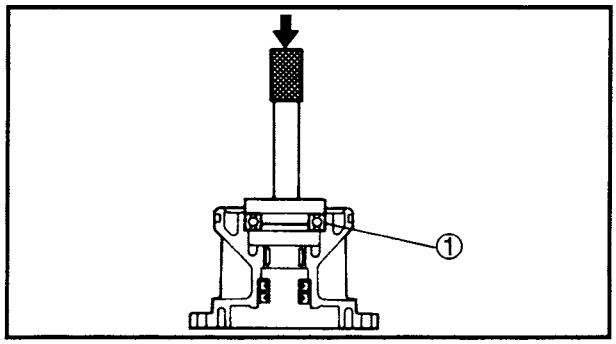
NOTE:

Install the needle bearing with its manufacture's marks or numbers toward the propeller side.

2. Install:
   - Oil seal ①

Oil seal installer:
YB-6078
Drive rod:
YB-6229

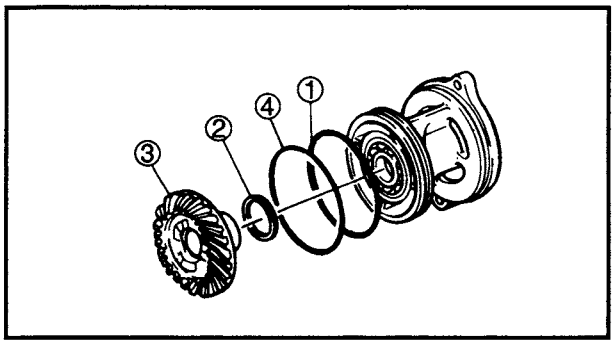
Depth ⓐ:
T9.9/FT9.9A:
4.5 ~ 5.0 mm (0.18 ~ 0.20 in)
F8B, F9.9/F9.9B:
3.0 ~ 3.5 mm (0.12 ~ 0.14 in)



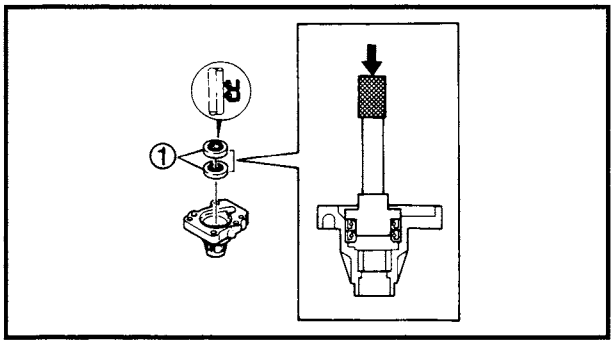
3. Install:
   - Ball bearing ①

Bearing installer:
YB-6015/90890-06632
Drive rod:
YB-6071/90890-06606

NOTE:
Install the bearing with its manufacture's marks or numbers facing outward.



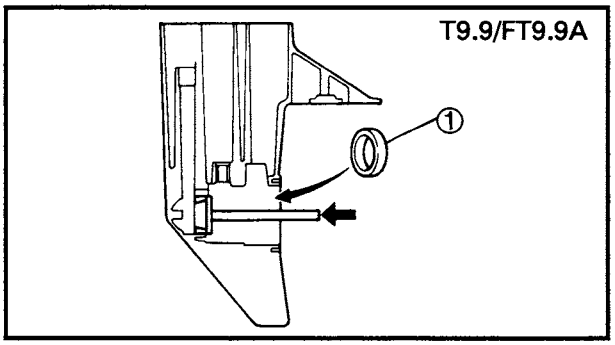
4. Install:
   - O-ring ①
   - Reverse gear shim ②
   - Reverse gear ③
   - O-ring ④



OIL SEAL HOUSING

1. Install:
   - O-ring ①

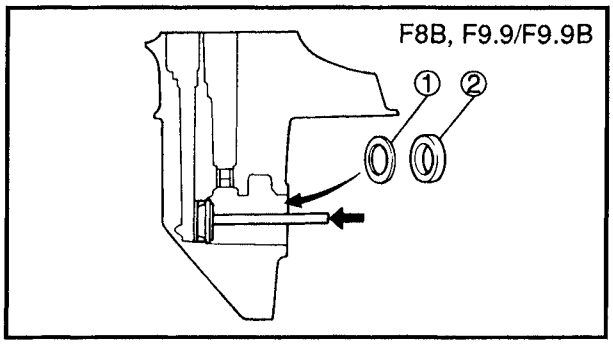
Oil seal installer:
YB-6022
Drive rod:
YB-6229



LOWER CASE

1. Install: (T9.9/FT9.9A)
   - Bearing outer race ①

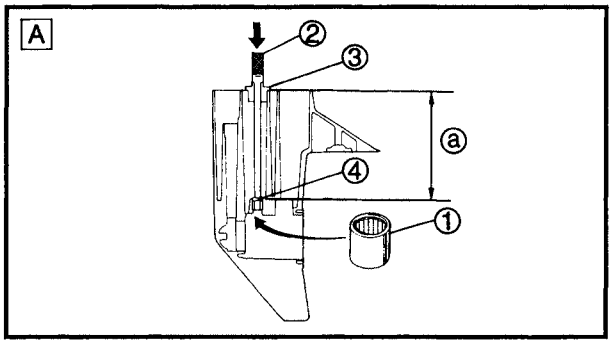
Bearing installer:
YB-6085/90890-06625
Drive rod:
YB-6071/90890-06605

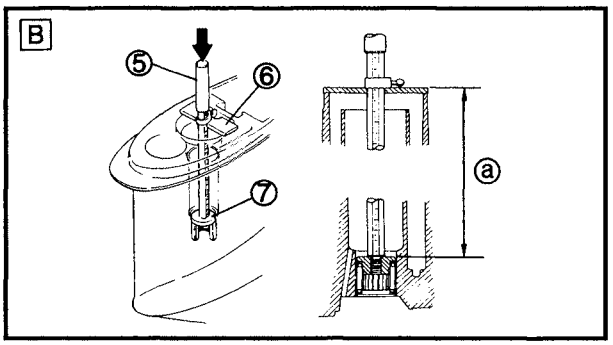


1. Install: (F8B, F9.9/F9.9B)
   - Forward gear shim ①
   - Bearing outer race ②

Bearing installer:
YB-6085/90890-06625
Drive rod:
YB-6071/90890-06605

NOTE:
The shim is installed for F9.9/F9.9B models only.





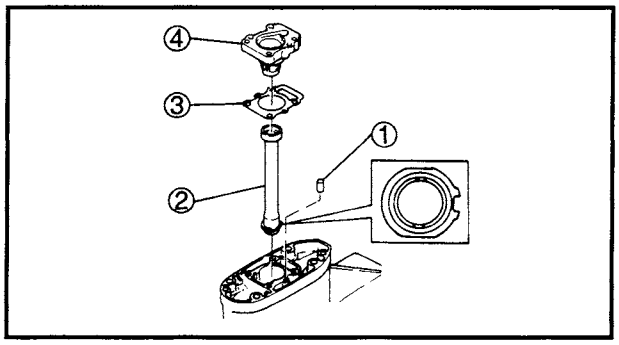
2. Install:
   - Needle bearing ①

Drive rod:
YB-6229 ..... ②
Needle bearing installer:
YB-6231 ..... ③
Needle bearing attachment:
T9.9: YB-6298 ..... ④
F9.9: YB-6230 ..... ④
Drive rod:
90890-06602 ..... ⑤
Bearing depth plate:
90890-06603 ..... ⑥
Needle bearing attachment:
FT9.9A: 90890-06618 ..... ⑦
F8B, F9.9B: 90890-06617 ..... ⑦

A For USA and CANADA
B Except for USA and CANADA

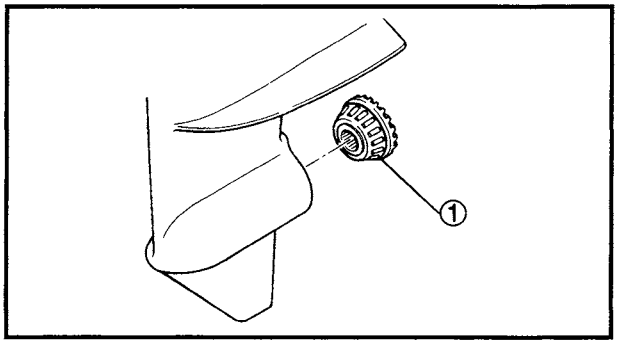
Depth ⓐ:
T9.9/FT9.9A:
199.6 ~ 200.1 mm
(7.86 ~ 7.88 in)
F8B, F9.9/F9.9B:
182.2 ~ 182.7 mm
(7.17 ~ 7.19 in)

NOTE:
Install the bearing with its manufacture's marks or numbers facing outward.

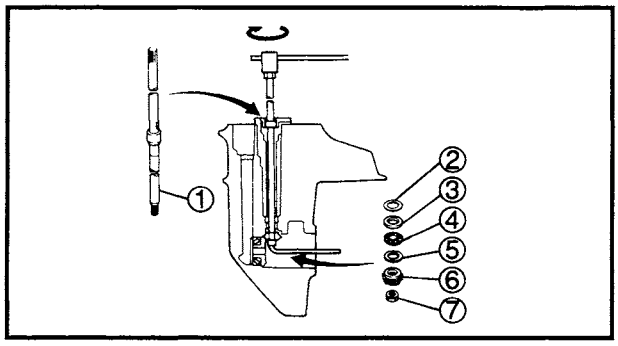


3. Install:
   - Dowel pin ①
   - Sleeve ②
   - Gasket ③
   - Oil seal housing ④

NOTE:
Install the sleeve with projection side backward.



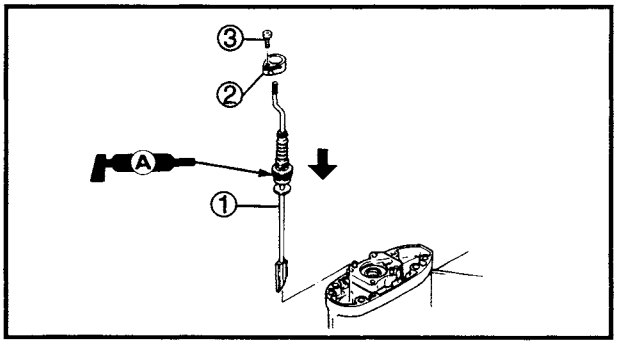
4. Install:
   - Forward gear complete ①



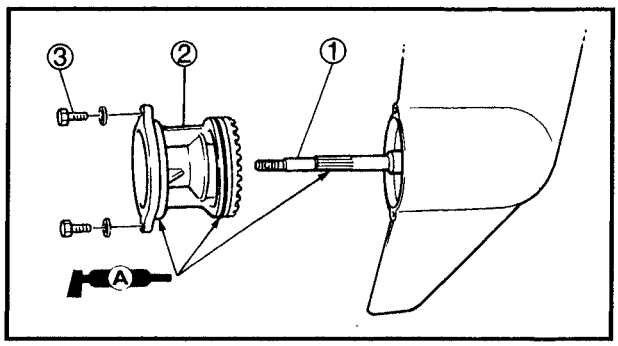
5. Install:
   - Drive shaft ①
   - Pinion gear shim ②
   - Washer (thick) ③
   - Bearing ④
   - Washer (thin) ⑤
   - Pinion gear ⑥
   - Nut ⑦

Pinion nut holder:
YB-6078
Drive shaft holder:
YB-6228/90890-06515

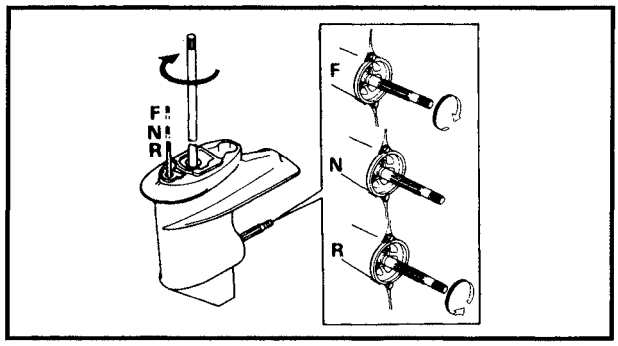
Nut:
26 Nm (2.6 m • kg, 19 ft • lb)



6. Install:
   - Shift shaft ①
   - Bracket ②
   - Screw ③

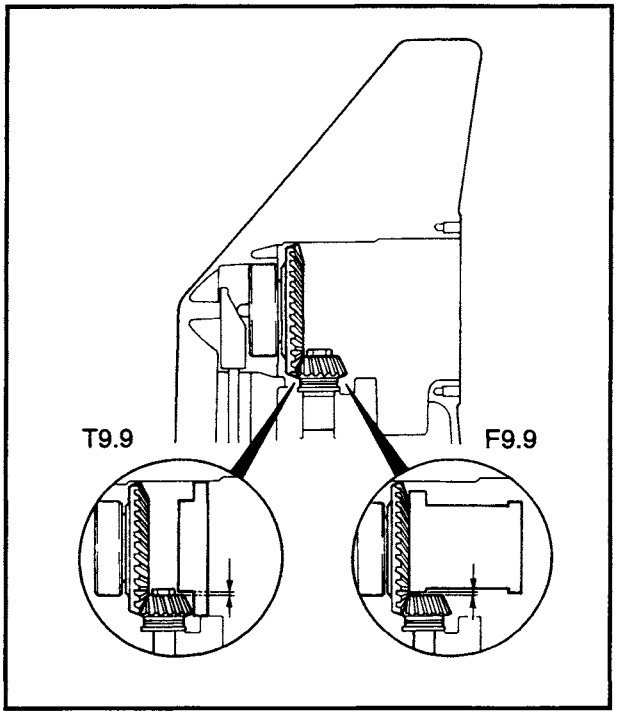


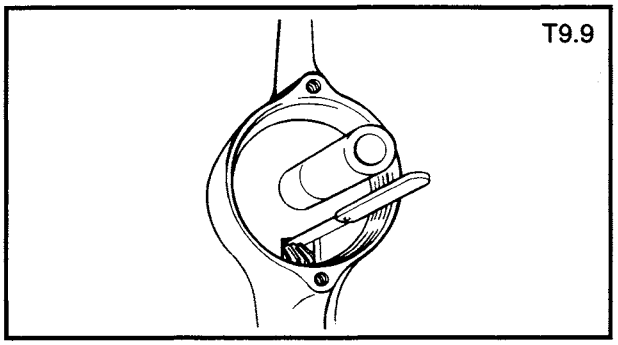
7. Install:
   - Propeller shaft complete ①
   - Reverse gear complete ②
   - Bolt ③

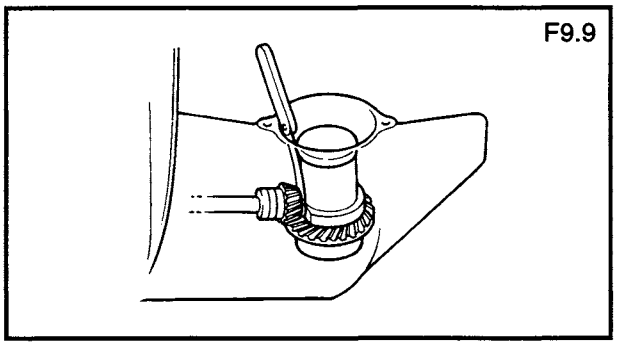


8. Check:
   - Shift cam operation
     Unsmooth operation → Repair.

NOTE:
Check that the dog clutch shifts to "Forward", "Neutral" and "Reverse" correctly.







SHIM SELECTION (For USA and CANADA)

NOTE:

- When reassembling the lower unit with the original gear case and inner parts, shim selection is not required.
- When replacing the gear case or inner parts, carry out the shim selection.

1. Measure:
   - Pinion gear clearance
     Out of specification → Adjust.

Clearance:
T9.9: 0.45 ~ 0.55 mm
F9.9: 1.15 ~ 1.25 mm

Measurement steps:
- Install the drive shaft components and tighten the nut to the specified torque.
- Attach the shimming tool into the gear case.

Pinion height gauge:
T9.9: YB-6299
F9.9: YB-34232

- Measure the clearance and determine the shim thickness.

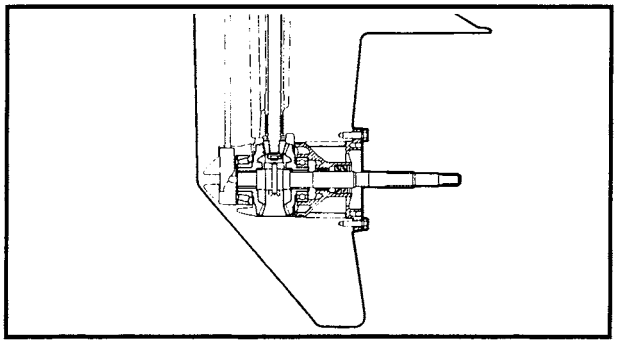
T9.9	
Less than 0.45 mm	To be decreased by (0.50 – measurement)
More than 0.55 mm	To be increased by (measurement – 0.50)
F9.9	
Less than 1.15 mm	To be decreased by (1.20 – measurement)
More than 1.25 mm	To be increased by (measurement – 1.20)

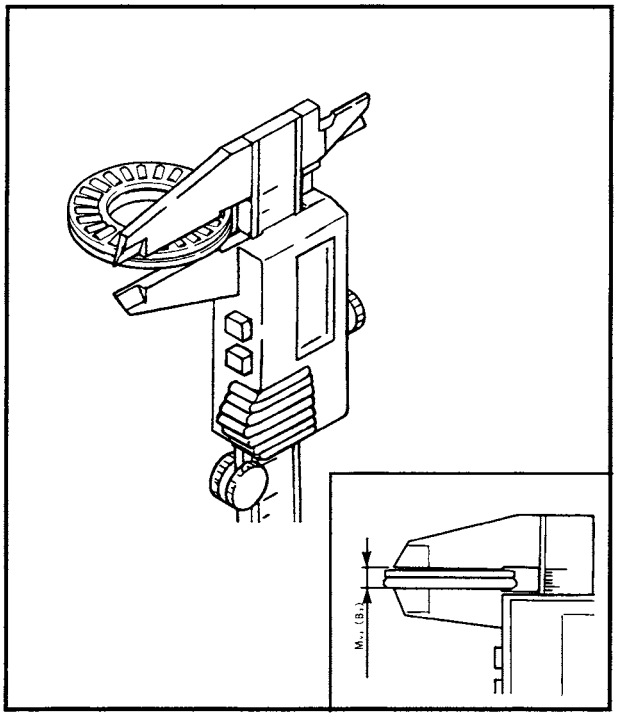
Example: (F8B, F9.9/F9.9B)
If measurement = 1.02 mm
Decrease shim thickness by
= 1.20 – 1.02
= 0.18 mm
If measurement = 1.32 mm
Increase shim thickness by
= 1.32 – 1.20
= 0.12 mm

Available shim thickness:
T9.9:
0.10, 0.14, 0.18 and 0.50 mm
F9.9:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

NOTE:

- Forward and reverse shim selection will be done by "BACKLASH MEASUREMENT" section.
- Since the smallest shim available is 0.10 mm, if the measurement is between (T9.9) 0.45 and 0.55 mm or (F9.9) 1.15 and 1.25 mm do not change the shim.





SHIM SELECTION
(Except for USA and CANADA)

NOTE:

- When reassembling the lower unit with the original gear case and inner parts, shim selection is not required.
- When replacing the gear case or inner parts, carry out the shim selection.

1. Adjust:
   - Pinion shim thickness

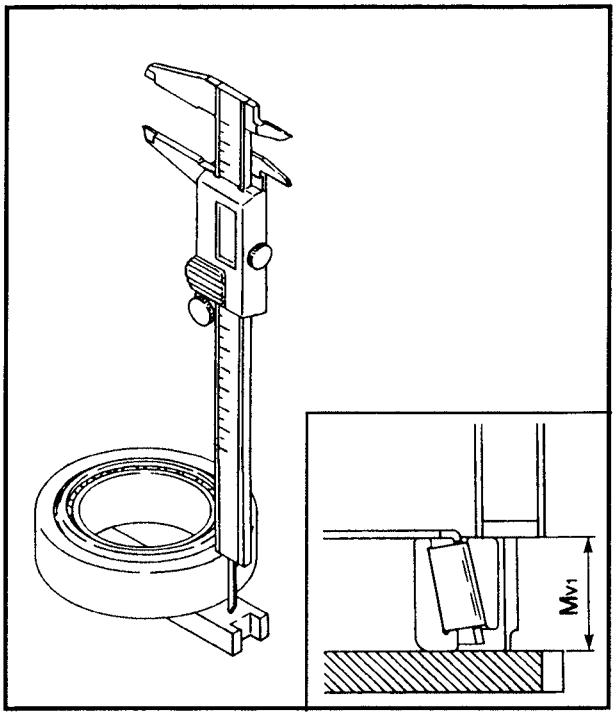
Adjustment steps:

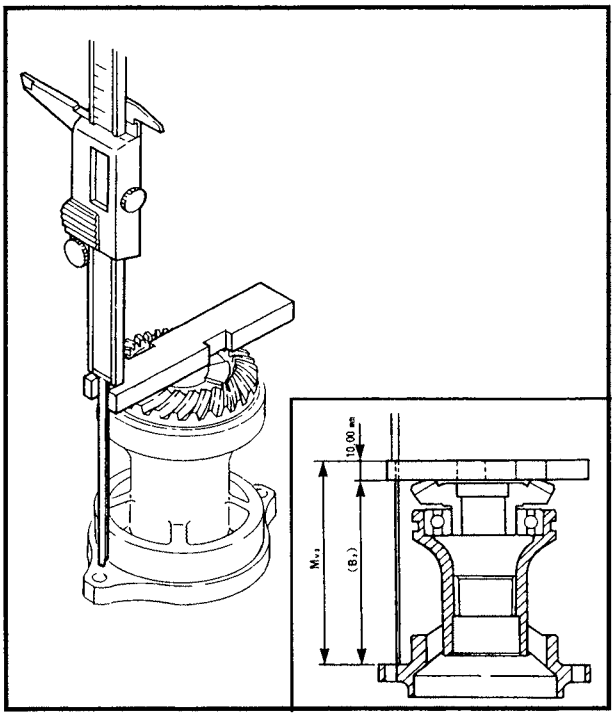
- Measure the thicknesses (Mv3) of bearing and washer.

Digital caliper:
90890-06704

- Use the following equation to calculate the pinion shim thickness (T3).

FT9.9A: T3 = 5.99 – Mv3
F8B, F9.9B: T3 = 6.05 – Mv3
Available shim thickness:
FT9.9A:
0.10, 0.14, 0.18, 0.35 and 0.50 mm
F8B, F9.9B:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm





2. Adjust:
   - Forward gear shim thickness

Adjustment steps:
- Measure the dimension (Mv1).

Shimming plate:
90890-06701
Digital caliper:
90890-06704

- Use the following equation to calculate the pinion shim thickness (T1).

FT9.9A: T1 = 16.50 – Mv1
F8B, F9.9B: T1 = 16.60 – Mv1
Available shim thickness:
FT9.9A:
0.10, 0.14, 0.18, 0.35 and 0.50 mm
F8B, F9.9B:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

3. Adjust:
   - Reverse gear shim thickness

Adjustment steps:
- Measure the dimension (Mv2).

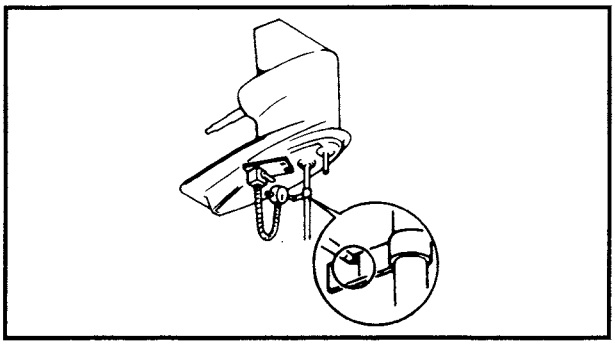
Shimming plate:
90890-06701
Digital caliper:
90890-06704

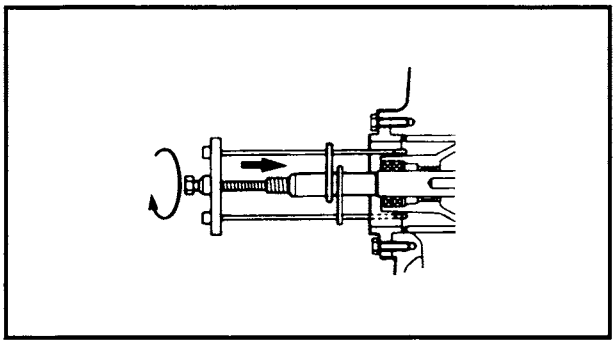
- Use the following equation to calculate the pinion shim thickness (T2).

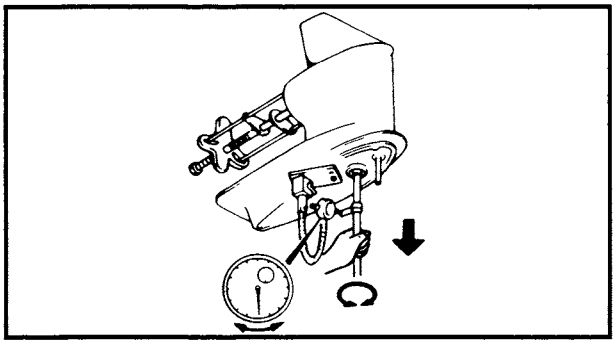
FT9.9A: T2 = 81.00 – Mv2
F8B, F9.9B: T2 = 80.57 – Mv2
Available shim thickness:
FT9.9A:
0.10, 0.14, 0.18, 0.35 and 0.50 mm
F8B, F9.9B:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

BACKLASH MEASUREMENT

NOTE:
- Both forward and reverse gear backlash should be measured.
- If both the forward and reverse gear backlash are larger than specified, the pinion may be too high.
- If both the forward and reverse gear backlash are smaller than specified, the pinion may be too low.
- If either of these conditions exists, then check the pinion shim selection.







1. Measure:
   - Forward gear backlash
     Out of specification → Adjust.

Backlash:
T9.9/FT9.9A: 0.26 ~ 0.77 mm
F8B, F9.9/F9.9B: 0.23 ~ 0.70 mm

Measurement steps:
- Place the shift shaft in neutral.
- Load the forward gear with the bearing housing puller on the propeller shaft.

NOTE:
Lightly tighten by hand until the pressure of the propeller shaft on the forward gear restricts movement enough to allow backlash measurement.

Bearing housing puller:
YB-6234/90890-06503
Universal puller:
YB-6117
Stopper guide stand:
90890-06501
Center bolt:
90890-06504

- Set the lower unit upside down.
- Attach the backlash indicator on the drive shaft.
- Attach the dial gauge on the gear case, and make the dial gauge stem contact the mark on the indicator.

Dial gauge:
YU-3097/90890-01252
Magnet base:
YU-34481/90890-06705
Backlash indicator:
YB-6265/90890-06706

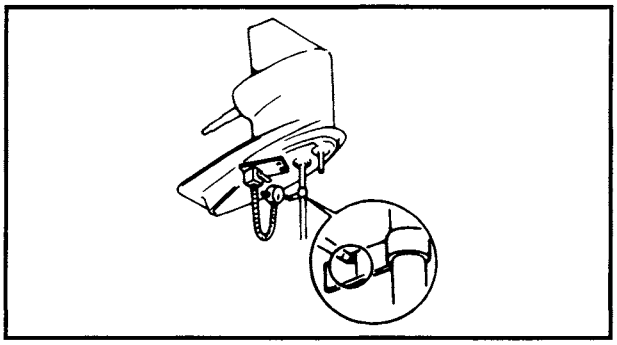
- While pulling the drive shaft downward, slowly turn the drive shaft clockwise and counterclockwise, then measure the backlash when the drive shaft stops at each direction.
- Determine the shims to be added or removed according to the specification.

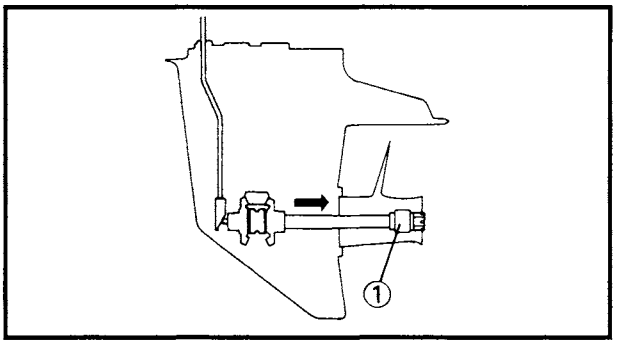
T9.9/FT9.9A	
Less than 0.26 mm	To be decreased by $\frac{(0.51 - \text{measurement})}{2.5}$
More than 0.77 mm	To be increased by $\frac{(\text{measurement} - 0.51)}{2.5}$
F8B, F9.9/F9.9B	
Less than 0.23 mm	To be decreased by $\frac{(0.47 - \text{measurement})}{2.3}$
More than 0.70 mm	To be increased by $\frac{(\text{measurement} - 0.47)}{2.3}$

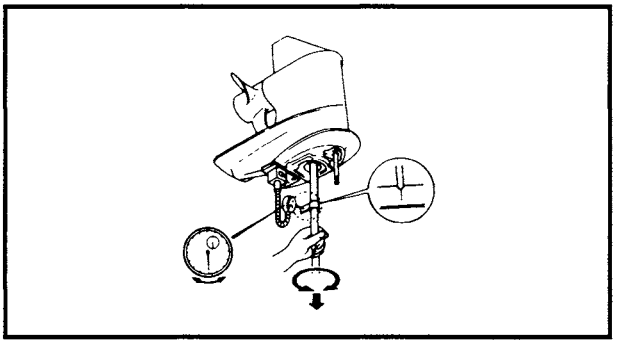
Example: (T9.9/FT9.9A)
If measurement = 0.25 mm
Decrease shim thickness by
= (0.51 – 0.25)/2.5
= 0.26/2.5 = 0.10 mm
If measurement = 1.26 mm
Increase shim thickness by
= (1.26 – 0.51)/2.5
= 0.75/2.5 = 0.3 mm

Available shim thickness:
T9.9/FT9.9A:
0.10, 0.14, 0.18, 0.35 and 0.50 mm
F8B, F9.9/F9.9B:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

NOTE:
Since the smallest shim available is 0.10 mm, if the measurement is between (T9.9/F9.9A) 0.26 and 0.77 mm or (F8B, F9.9/F9.9B) 0.23 and 0.70 mm, do not change the shim.







2. Measure:
   - Reverse gear backlash
     Out of specification → Adjust.

Backlash:
T9.9/FT9.9A: 0.51 ~ 1.02 mm
F8B, F9.9/F9.9B: 0.82 ~ 1.16 mm

Measurement steps:
- Place the shift shaft in neutral.
- Load the reverse gear by installing the propeller without the front side spacer ① and tighten the nut.

NOTE:
Lightly tighten by hand until the pressure of the propeller shaft on the reverse gear restricts movement enough to allow backlash measurement.

- Set the lower unit upside down.
- Attach the backlash indicator on the drive shaft.
- Attach the dial gauge on the gear case, and make the dial gauge stem contact the mark on the indicator.

Dial gauge:
YU-3097/90890-01252
Magnet base:
YU-34481/90890-06705
Backlash indicator:
YB-6265/90890-06706

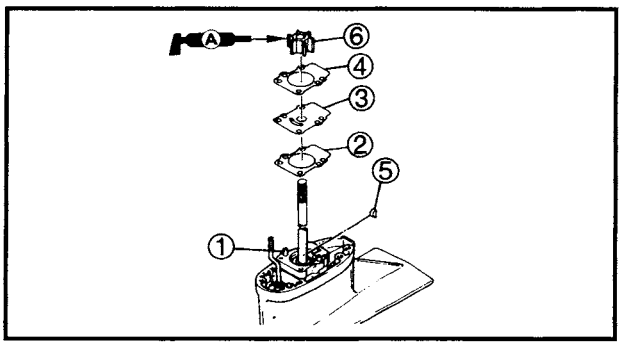
- While pulling the drive shaft downward, slowly turn the drive shaft clockwise and counterclockwise, then measure the backlash when the drive shaft stops at each direction.
- Determine the shims to be added or removed according to the specified.

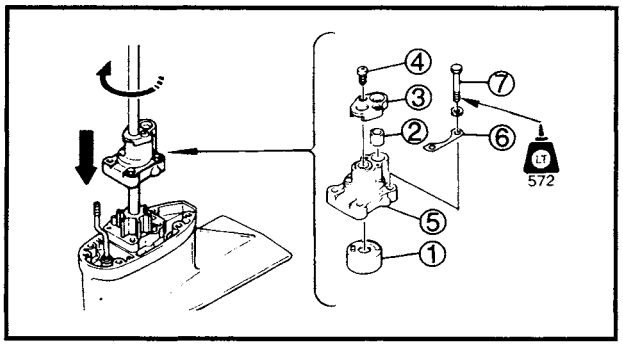
T9.9/FT9.9A	
Less than 0.51 mm	To be decreased by $\frac{(0.77 - \text{measurement})}{2.5}$
More than 1.02 mm	To be increased by $\frac{(\text{measurement} - 0.77)}{2.5}$
F8B, F9.9/F9.9B	
Less than 0.82 mm	To be decreased by $\frac{(0.99 - \text{measurement})}{2.3}$
More than 1.17 mm	To be increased by $\frac{(\text{measurement} - 0.99)}{2.3}$

Example: (F8B, T9.9/F9.9B)
If measurement = 0.74 mm
Decrease shim thickness by
= (0.99 – 0.74)/2.3
= 0.25/2.3 = 0.11 mm
If measurement = 1.79 mm
Increase shim thickness by
= (1.79 – 0.99)/2.3
= 0.80/2.3 = 0.35 mm

Available shim thickness:
T9.9/FT9.9A:
0.10, 0.14, 0.18, 0.35 and 0.50 mm
F8B, F9.9/F9.9B:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

NOTE:
Since the smallest shim available is 0.10 mm, if the measurement is between (T9.9/FT9.9A) 0.51 and 1.02 mm or (F8B, F9.9/F9.9B) 0.82 and 1.17 mm, do not change the shim.





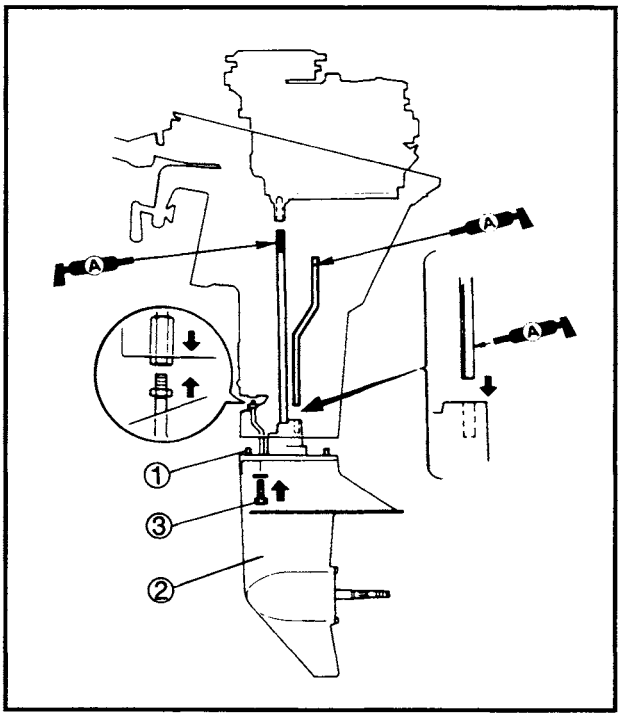
WATER PUMP

1. Install:
   - Dowel pin ①
   - Gasket ②
   - Outer plate ③
   - Gasket ④
   - Woodruff key ⑤
   - Impeller ⑥

2. Install:
   - Insert cartridge ①
   - Bushing ②
   - Cover ③
   - Screw ④
   - Water pump housing ⑤
   - Plate ⑥
   - Bolt ⑦

NOTE:

- Apply the impeller with water resistant grease.
- Turn the drive shaft clockwise, when installing the water pump housing.

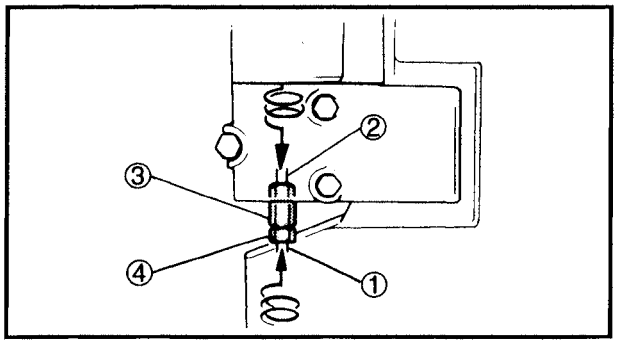


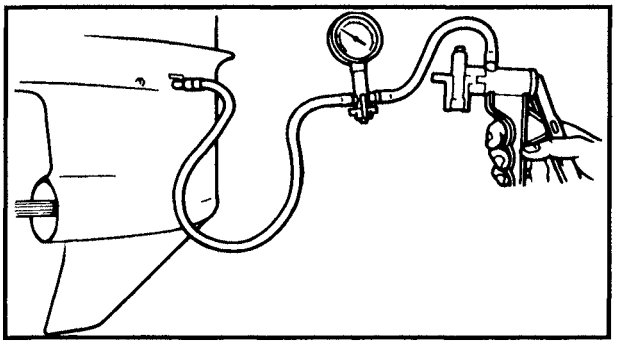
LOWER UNIT

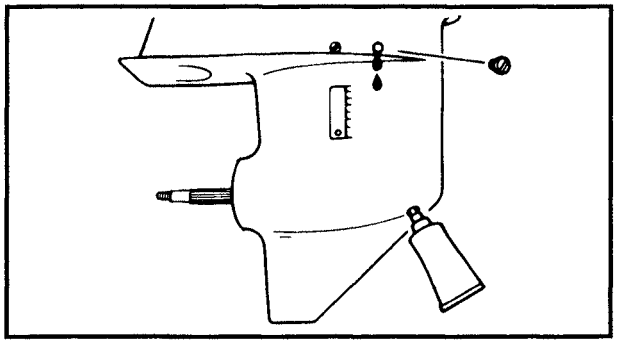
1. Install:
   - Dowel pin ①
   - Lower unit ②
   - Bolt ③

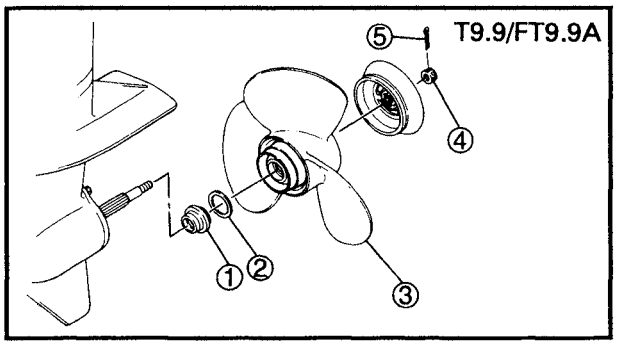
NOTE:

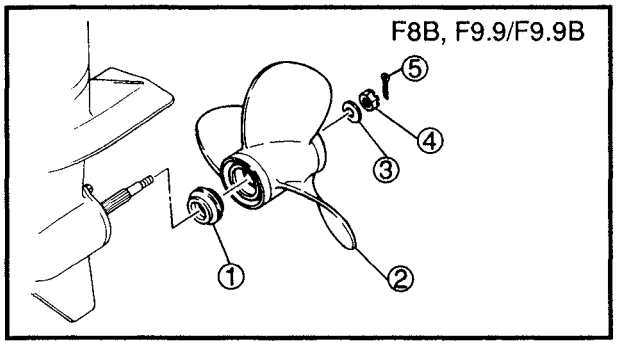
- Set the shift cam to the reverse position.
- Hold the shift rod nut in the lowest position.
- Insert the drive shaft into the crankshaft, insert the water tube into the water seal, and insert the shift rod into the upper casing.











2. Install:
   - Shift rod ①
   - Shift lever ②
   - Nut ③
   - Lock nut ④

NOTE:
Install the nut on the shift lever side and screw it in 5 turns.

3. Check:
   - Pressure
     Impossible to maintain the specified pressure for 10 seconds → Reinstall.

Checking steps:
- Attach the Mity Vac to the oil level hole.

Mity Vac:
YB-35956/90890-06756

- Apply the specified pressure.

Specified pressure:
100 kPa (1.0 kg/cm², 14.2 psi)

4. Fill:
   - Gear oil
     Refer to page 3-5.

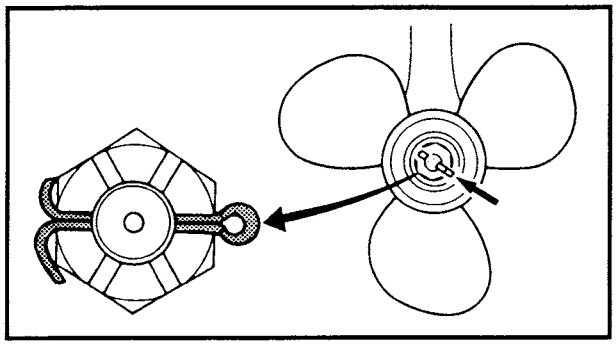
PROPELLER

1. Install: (T9.9/FT9.9A)
   - Spacer ①
   - Washer ②
   - Propeller ③
   - Nut ④
   - Cotter pin ⑤

Nut:
13 Nm (1.3 m • kg, 9.4 ft • lb)

1. Install: (F8B, F9.9/F9.9B)
   - Spacer ①
   - Propeller ②
   - Washer ③
   - Nut ④
   - Cotter pin ⑤

Nut:
13 Nm (1.3 m • kg, 9.4 ft • lb)



NOTE:

If the propeller nut does not align with the propeller shaft hole when the nut is tightened to specification, turn it in further so that they align.

CHAPTER 7
BRACKET UNIT

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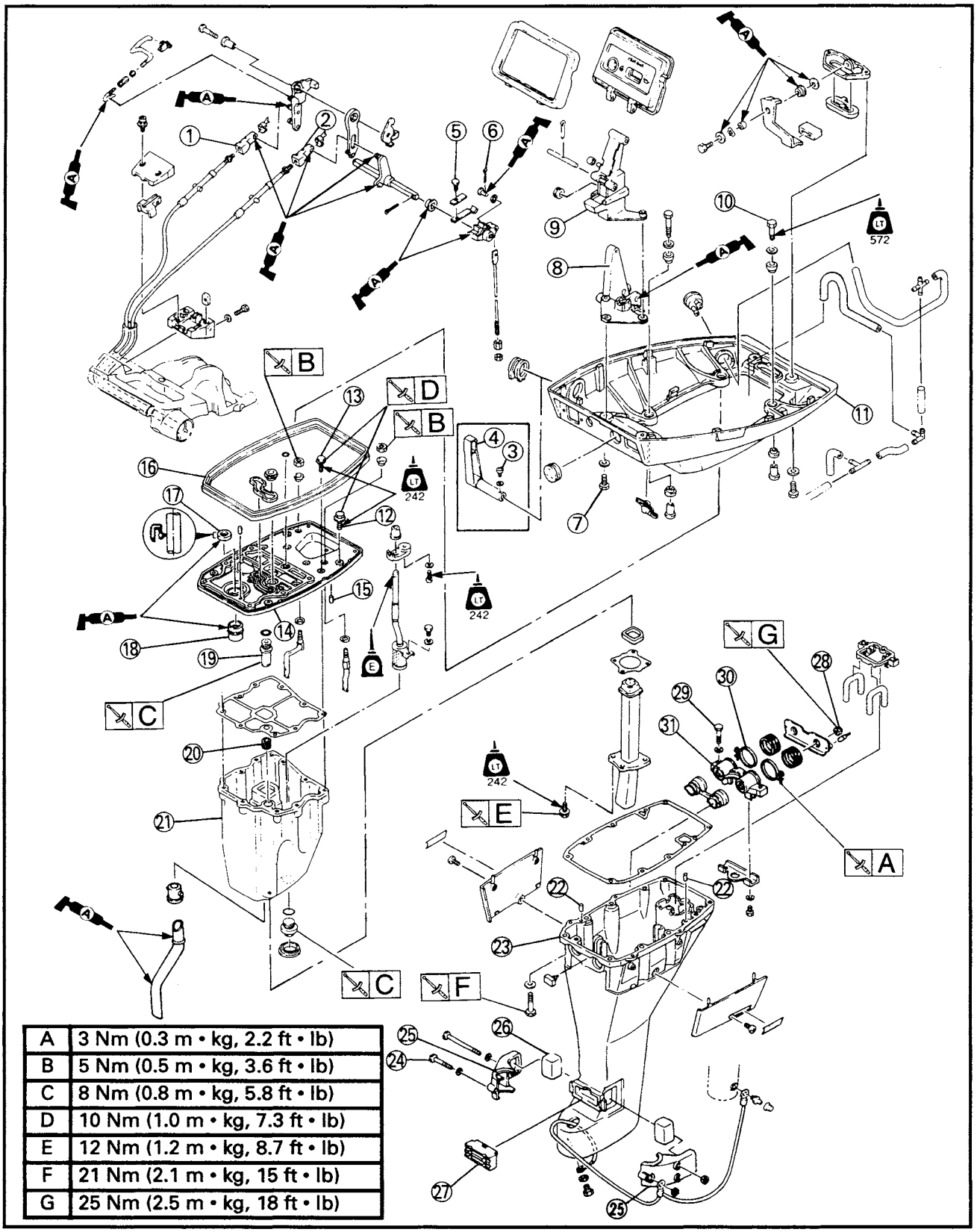
UPPER CASING AND BOTTOM COWLING

PREPARATION FOR REMOVAL

* Remove the power unit.
* Remove the ground lead at the swivel bracket side.

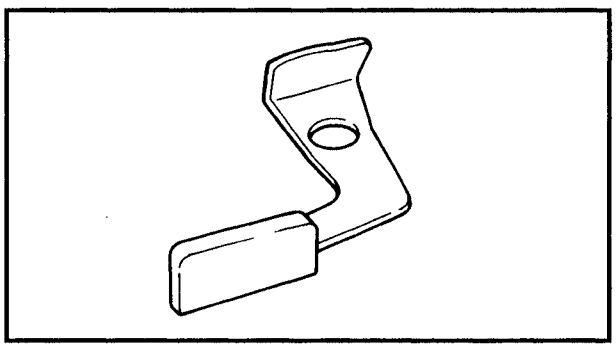


A	3 Nm (0.3 m • kg, 2.2 ft • lb)
B	5 Nm (0.5 m • kg, 3.6 ft • lb)
C	8 Nm (0.8 m • kg, 5.8 ft • lb)
D	10 Nm (1.0 m • kg, 7.3 ft • lb)
E	12 Nm (1.2 m • kg, 8.7 ft • lb)
F	21 Nm (2.1 m • kg, 15 ft • lb)
G	25 Nm (2.5 m • kg, 18 ft • lb)

UPPER CASING AND BOTTOM COWLING

Extent of removal: ① Bottom cowling removal ② Upper casing removal ③ Mount rubber removal

Extent of removal	Order	Part name	Q'ty	Remarks
	1	Cable end (throttle)	1	
	2	Cable end (shift)	1	T9.9/FT9.9A models only.
	3	Screw	1	
	4	Shift lever	1	F8B, F9.9/F9.9B models only
	5	Bolt	1	
①	6	Shift rod pin	1	
	7	Bolt	3	
② ③	8	Shift stay	1	
	9	Panel stay	1	
	10	Bolt	4	
	11	Bottom cowling	1	
	12	Bolt	2	
	13	Bolt	9	
	14	Exhaust guide	1	
	15	Dowel pin	2	
	16	Rubber seal	1	
	17	Oil seal	1	
	18	Pipe	1	
	19	Relief valve	1	
	20	Seal	1	
	21	Oil pan	1	
②	22	Dowel pin	2	
	23	Upper casing	1	
	24	Bolt	3	
	25	Rubber housing	2	
	26	Mount rubber (side)	2	
③	27	Mount rubber (under)	1	
	28	Nut	2	
	29	Bolt	2	
	30	Clamp	2	Loosen the screw.
	31	Mount rubber (upper)	1	



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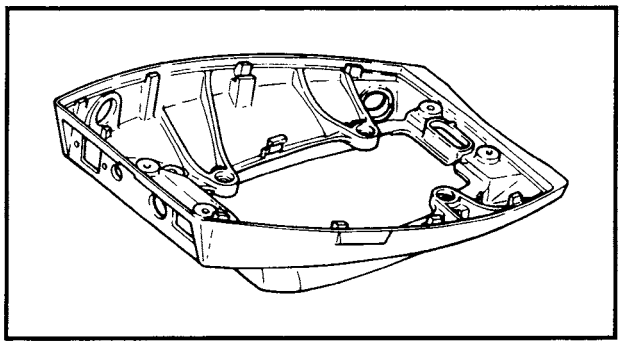
INSPECTION

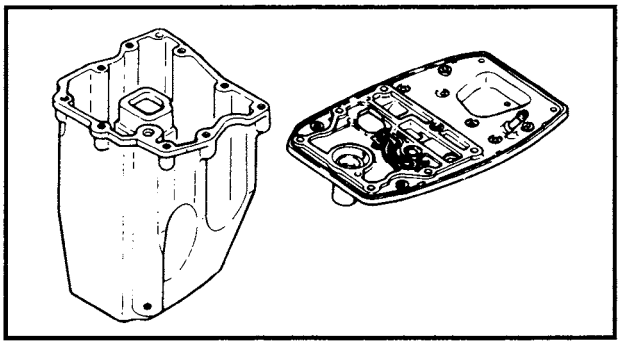
CLAMP LEVER

1. Inspect:
   - Clamp lever
     Wear/Damage → Replace.



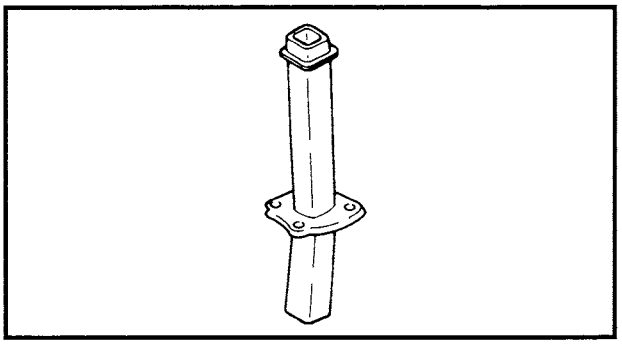
BOTTOM COWLING

1. Inspect:
   - Bottom cowling
     Crack/Damage → Replace.



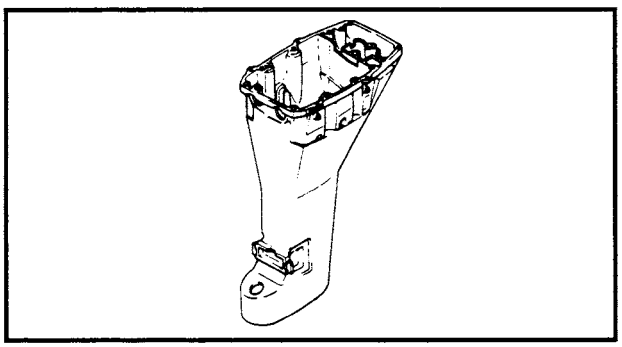
OIL PAN AND EXHAUST GUIDE

1. Inspect:
   - Oil pan
   - Exhaust guide
     Crack/Damage → Replace.



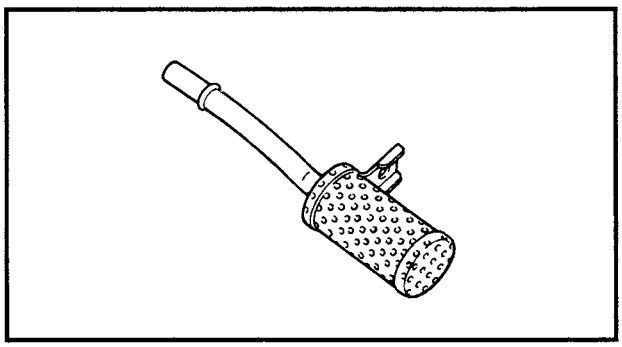
EXHAUST MANIFOLD

1. Inspect:
   - Exhaust manifold
     Carbon deposits → Clean.
     Crack/Corrosion → Replace.



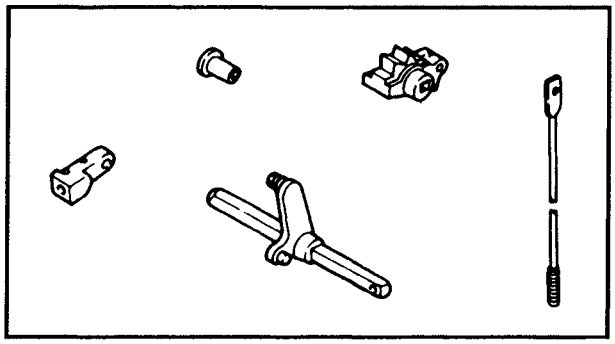
UPPER CASING

1. Inspect:
   - Upper casing
     Crack/Damage → Replace.



OIL STRAINER

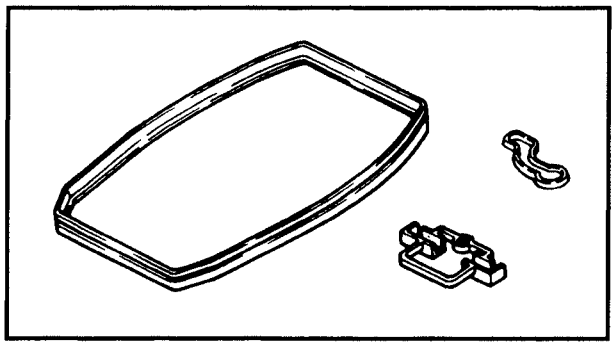
1. Inspect:
   - Oil strainer
     Contamination → Clean.
     Damage → Replace.



SHIFT MECHANISM

1. Inspect:
   - Shift rod
   - Shift link
   - Bushing
   - Cable end

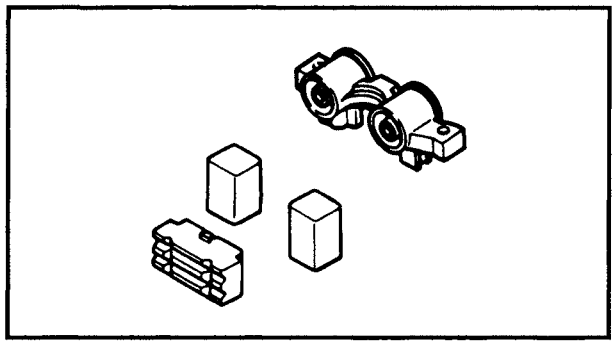
   Wear/Damage → Replace.



SEALING PARTS

1. Inspect:
   - Rubber seal

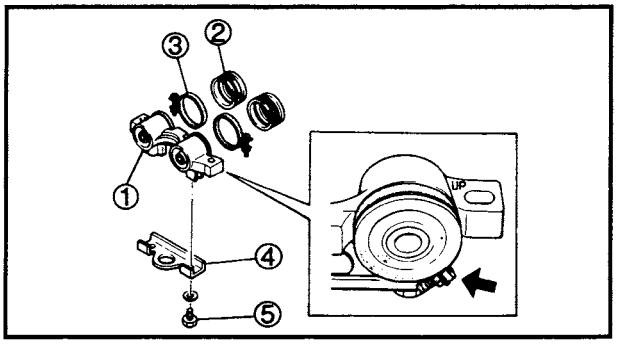
   Crack/Damage → Replace.



MOUNT RUBBER

1. Inspect:
   - Mount rubber

   Wear/Damage → Replace.



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ASSEMBLY AND INSTALLATION

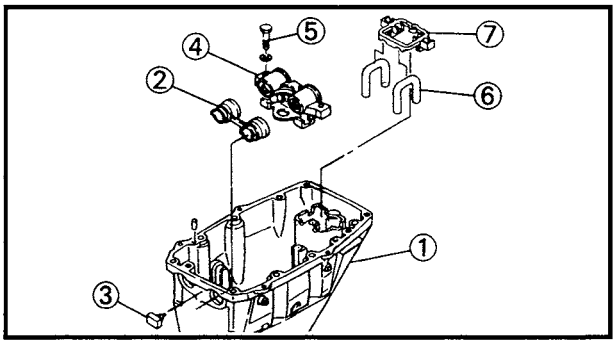
UPPER CASING

1. Install:
   - Mount rubber ①
   - Rubber seal ②
   - Clamp ③
   - Plate ④
   - Bolt ⑤

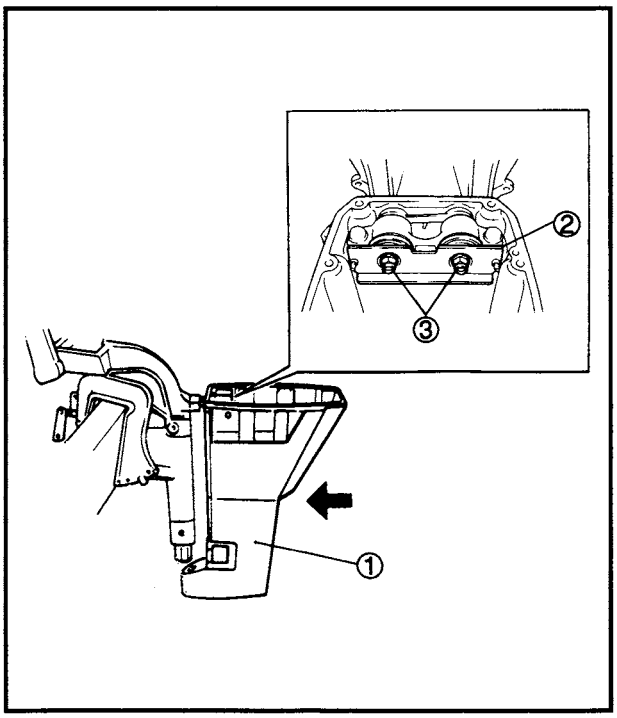
NOTE:

The clamp should be installed with the screwed side facing downward.

	Screw: **3 Nm (0.3 m • kg, 2.2 ft • lb)**

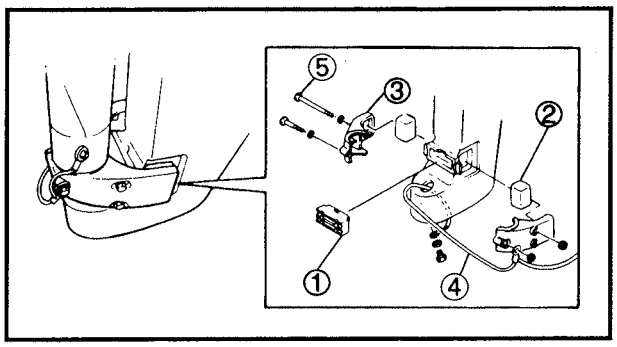


2. Install:
   - Upper casing ①
   - Seal ②
   - Stopper ③
   - Mount rubber ④
   - Bolt ⑤
   - Hose ⑥
   - Seal ⑦

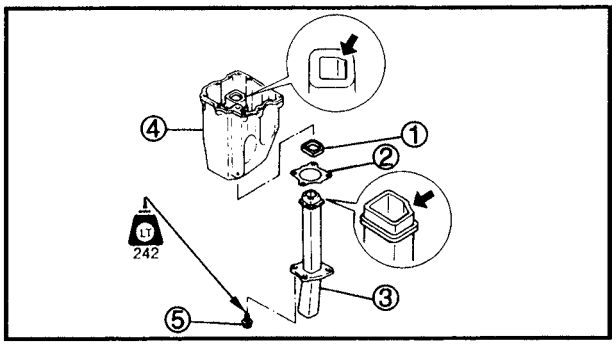


3. Install:
   - Upper casing ①
   - Bracket ②
   - Nut ③

	Nut: **25 Nm (2.5 m • kg, 18 ft • lb)**



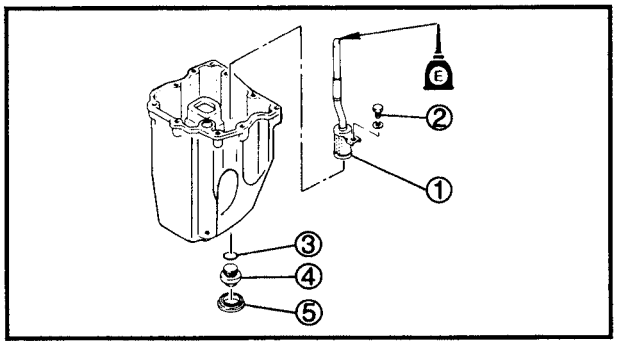
4. Install:
   - Mount rubber (under) ①
   - Mount rubber (side) ②
   - Rubber housing ③
   - Ground lead ④
   - Bolt ⑤



5. Install:
   - Seal ①
   - Gasket ②
   - Exhaust manifold ③
   - Oil pan ④
   - Bolt ⑤

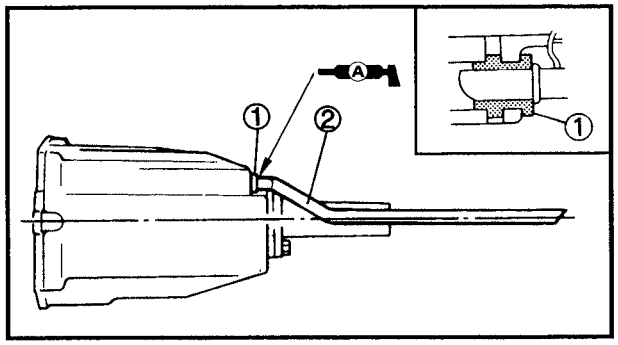
	Bolt: **12 Nm (1.2 m • kg, 8.7 ft • lb)**

NOTE:
- Align the exhaust manifold with the oil pan hole.
- Always use a new gasket.



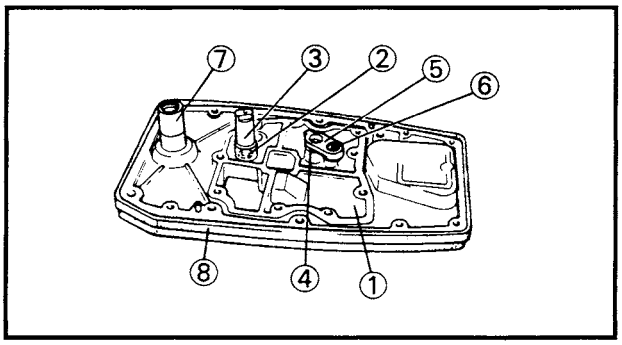
6. Install:
   - Oil strainer ①
   - Bolt ②
   - O-ring ③
   - Drain plug ④
   - Rubber damper ⑤

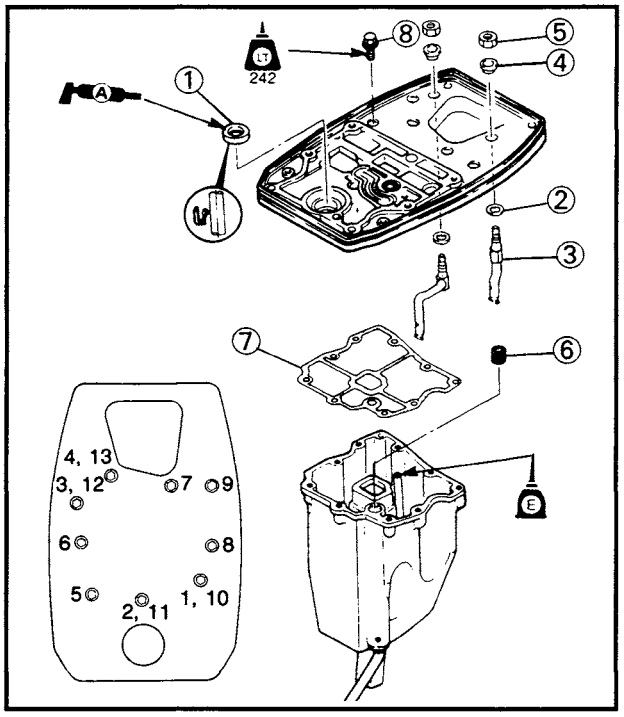
	Drain plug: **8 Nm (0.8 m • kg, 5.8 ft • lb)**

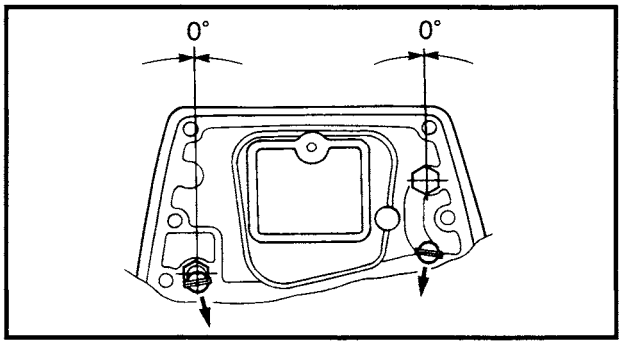


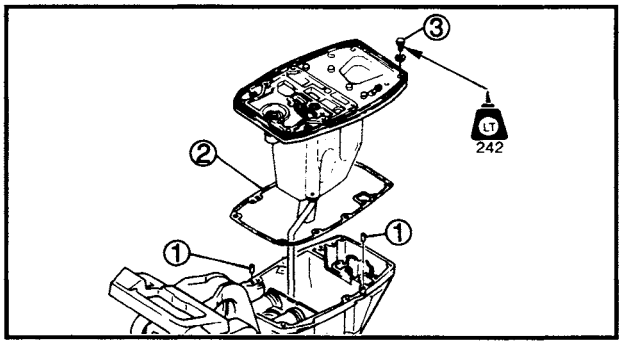
7. Install:
   - Grommet ①
   - Water tube ②

NOTE:
- Align the hole in the oil pan with the projection in the grommet.
- Install the water tube so its position is not reversed.









8. Install:
   - Exhaust guide ①
   - O-ring ②
   - Relief valve ③
   - Grommet ④
   - Pipe guide ⑤
   - Screw ⑥
   - Pipe ⑦
   - Rubber seal ⑧

	Relief valve: **8 Nm (0.8 m • kg, 5.8 ft • lb)**

CAUTION:

Coat the screw with blue LOCTITE® (242).

9. Install:
   - Oil seal ①
   - Washer ②
   - Pipe ③
   - Bushing ④
   - Nut ⑤
   - Seal ⑥
   - Gasket ⑦
   - Bolt ⑧

	Nut: **5 Nm (0.5 m • kg, 3.6 ft • lb)** **Bolt:** **10 Nm (1.0 m • kg, 7.3 ft • lb)**

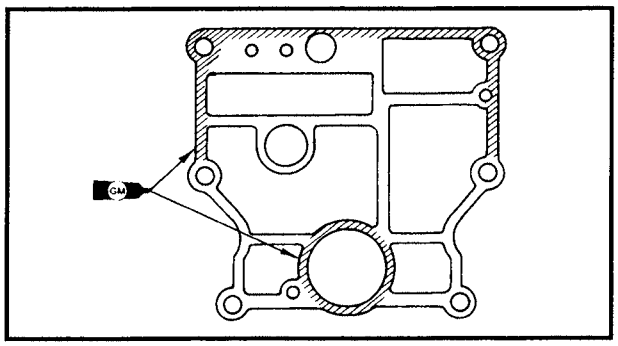
NOTE:

- Always use a new oil seal.
- Torque the bolts in the sequence embossed on the exhaust guide.
- Install the pipes with their water discharge end facing the oil pan.

10. Install:
    - Dowel pin ①
    - Gasket ②
    - Bolt ③

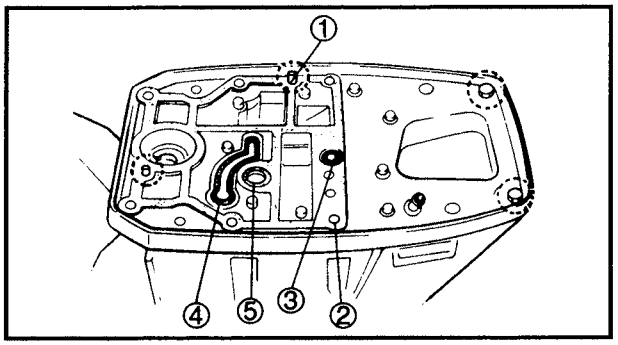
NOTE:

Always use a new gasket.



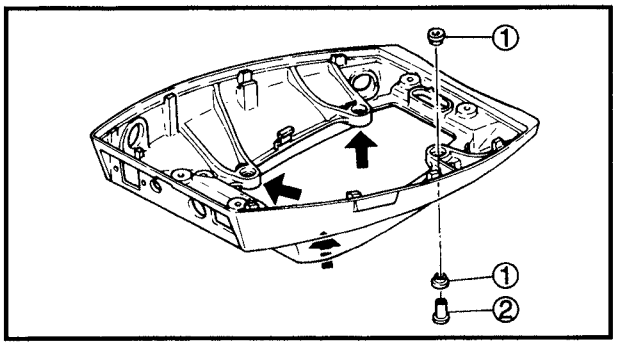
11. Apply:
- Gasket Maker
  (onto both face of the gasket)

NOTE:
Clean the contacting surface of the crankcase.



12. Install:
- Dowel pin ①
- Gasket ②
- O-ring ③
- Rubber seal ④
- Rubber seal ⑤

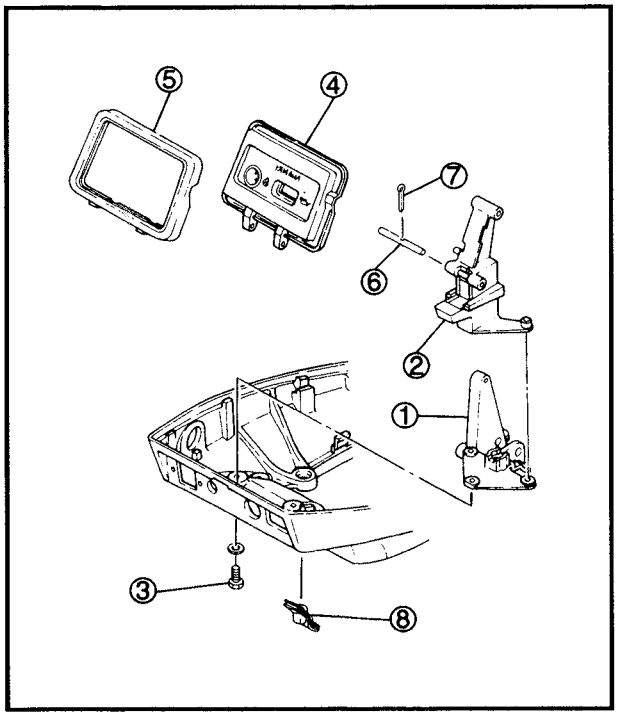
NOTE:
Always use a new gasket.



K35150-0

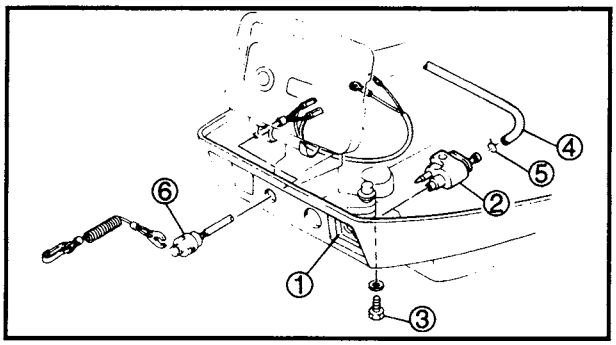
BOTTOM COWLING

1. Install:
- Grommet ①
- Collar ②



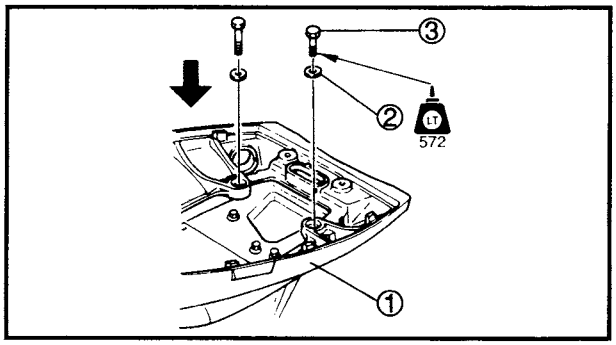
2. Install:
- Shift stay ①
- Panel stay ②
- Bolt ③
- Front panel ④
- Seal rubber ⑤
- Hinge pin ⑥
- Cotter pin ⑦
- Grommet (shift rod) ⑧

NOTE:
Always use a new cotter pin.

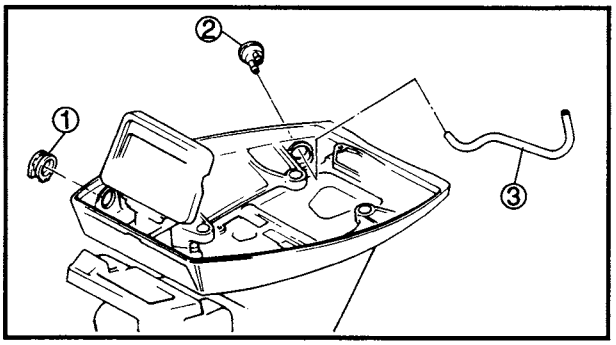


3. Install:
   - Grommet ①
   - Fuel joint ②
   - Bolt ③
   - Fuel hose ④
   - Clip ⑤
   - Engine stop switch ⑥

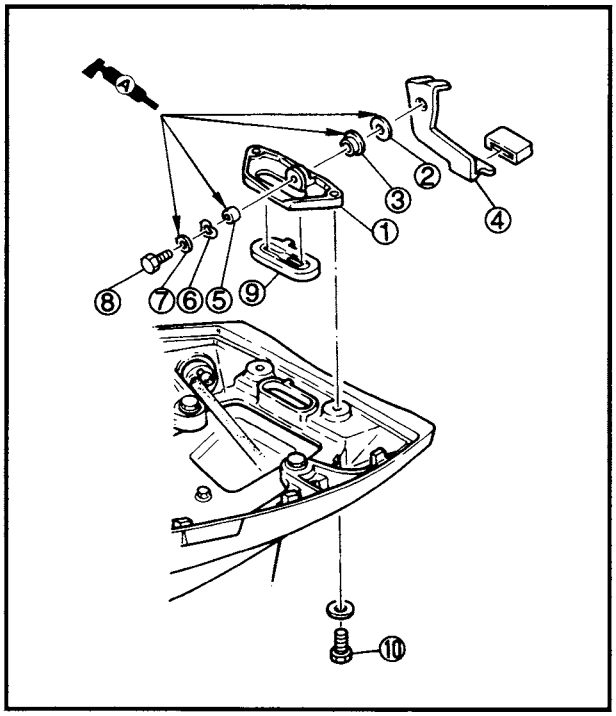
Engine stop switch:
4 Nm (0.4 m • kg, 2.9 ft • lb)



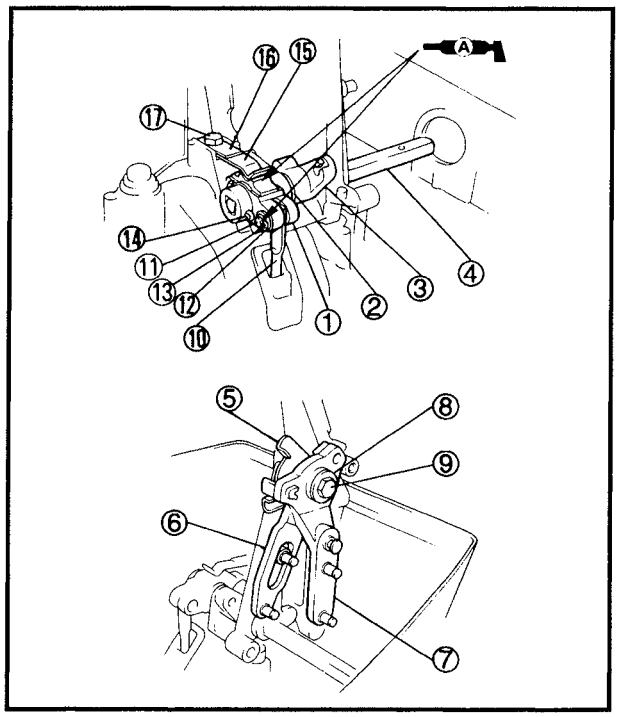
4. Install:
   - Bottom cowling ①
   - Washer ②
   - Bolt ③



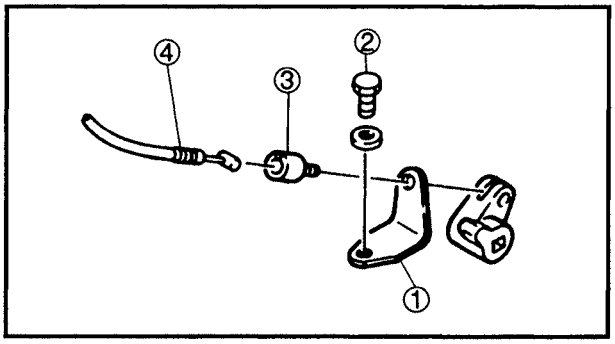
5. Install:
   - Grommet (shift shaft) ①
   - Grommet ②
   - Water hose ③



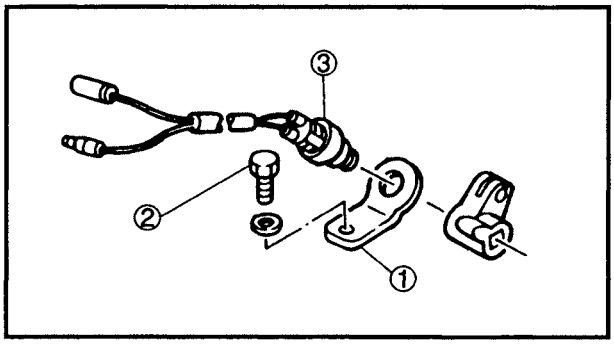
6. Install:
   - Lever stay ①
   - Washer ②
   - Bushing ③
   - Clamp lever ④
   - Collar ⑤
   - Wave washer ⑥
   - Washer ⑦
   - Bolt ⑧
   - Rubber seal ⑨
   - Bolt ⑩



7. Install:
   - Shift link ①
   - Bushing ②
   - Shift lever ③
   - Shift arm ④
   - Accelerator stopper ⑤
   - Shift arm ⑥
   - Accelerator arm ⑦
   - Bushing ⑧
   - Bolt ⑨
   - Shift rod ⑩
   - Pin ⑪
   - Washer ⑫
   - Cotter pin ⑬
   - Cotter pin ⑭
   - Spring ⑮
   - Bracket ⑯
   - Bolt ⑰



8. Install: (F8BMH, T9.9MH/FT9.9AMH, F9.9MH/F9.9BMH)
   - Stay ①
   - Bolt ②
   - Guide ③
   - Start-in-gear protection wire ④



9. Install: (F8BE, F8BEH, FT9.9AE, T9.9EH/FT9.9AEH, F9.9BE, F9.9EH/F9.9BEH)
   - Stay ①
   - Bolt ②
   - Neutral switch ③

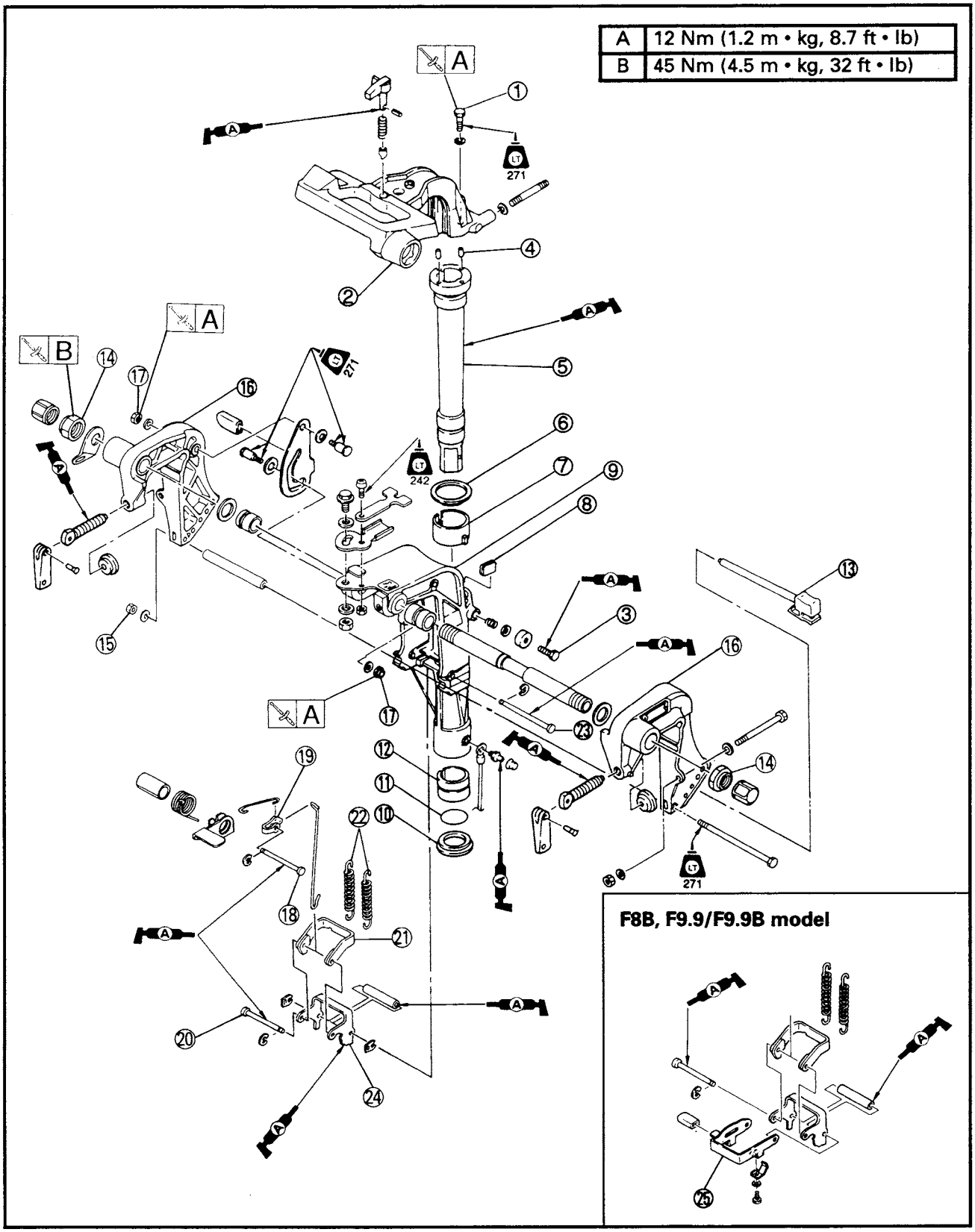
K15650-0

BRACKET UNIT

PREPARATION FOR REMOVAL

* Remove the power unit.
* Remove the upper casing and bottom cowling.

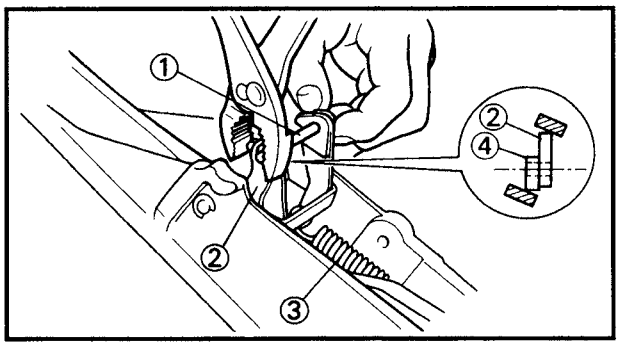
A	12 Nm (1.2 m • kg, 8.7 ft • lb)
B	45 Nm (4.5 m • kg, 32 ft • lb)



BRACKET UNIT

Extent of removal: ① Swivel bracket removal ② Clamp bracket removal ③ Swivel bracket disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
①	1	Bolt	2	
	2	Steering bracket	1	
	3	Bolt	1	
	4	Dowel pin	2	
	5	Steering shaft	1	
	6	Washer	1	
	7	Bushing	1	
	8	Friction plate	1	
	9	Swivel bracket	1	
	10	Bushing	1	
③	11	O-ring	1	
	12	Bushing	1	
	13	Tilt pin	1	
②	14	Nut	2	
	15	Nut (M6)	1	
	16	Clamp bracket	2	
	17	Nut	2	
	18	Pin	1	T9.9/FT9.9A models only
	19	Tilt lever	1	T9.9/FT9.9A models only
	20	Pin	1	
	21	Tilt plate (inner)	1	
	22	Spring	2	Refer to "REMOVAL POINTS".
	23	Pin	1	
	24	Tilt plate (outer)	1	F8B, F9.9/F9.9B models only
	25	Drive lever	1	



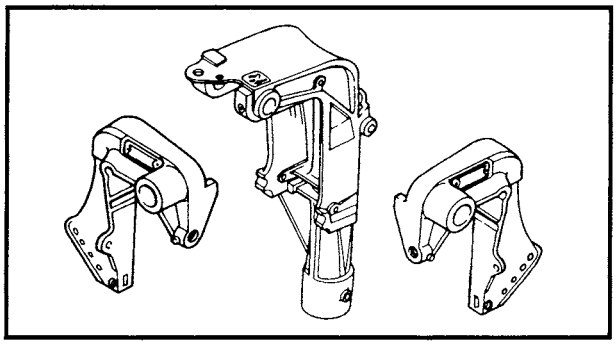
REMOVAL POINTS

SPRING

1. Remove:
   - Clip
   - Pin ①
   - Tilt plate (inner) ②
   - Spring ③

NOTE:

Align the holes of the tilt plate (inner and outer ④), and remove the pin.



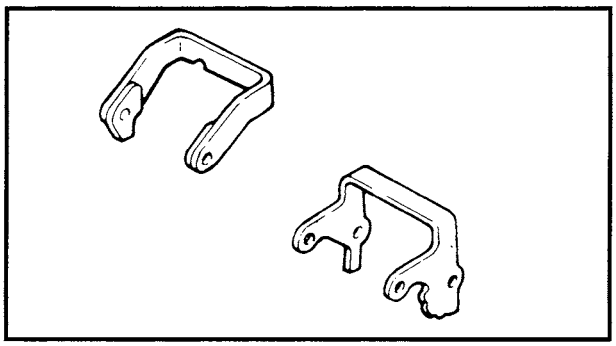
K30150-0

INSPECTION

CLAMP AND SWIVEL BRACKET

1. Inspect:
   - Clamp bracket
   - Swivel bracket

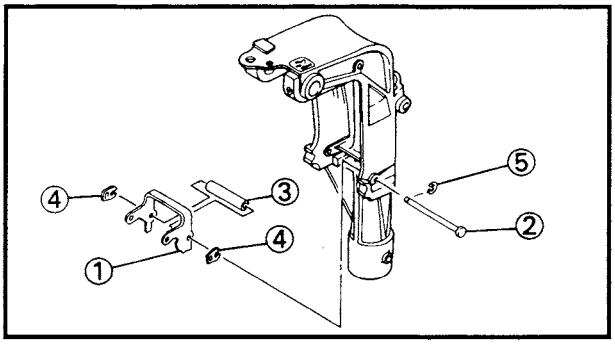
   Crack/Damage → Replace.



TILT PLATE

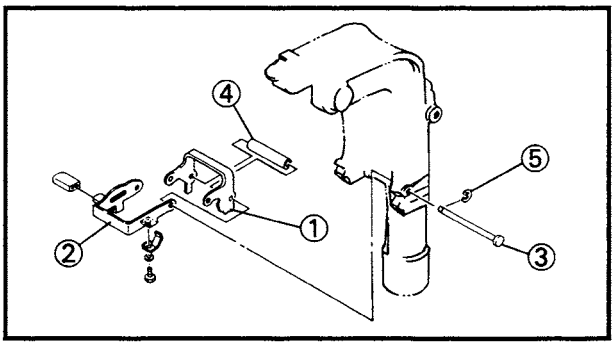
1. Inspect:
   - Tilt plate

   Crack/Damage → Replace.

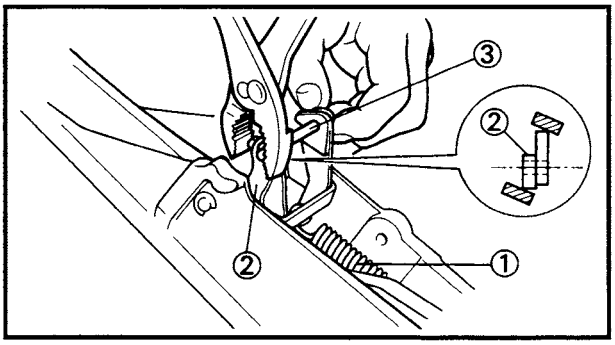


ASSEMBLY AND INSTALLATION

1. Install: (T9.9/FT9.9A models)
   - Tilt plate (outer) ①
   - Pin ②
   - Collar ③
   - Spacer ④
   - Clip ⑤



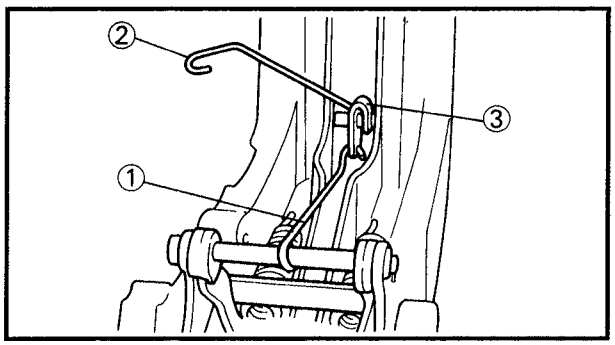
1. Install: (F8B, F9.9/F9.9B models)
   - Tilt plate (outer) ①
   - Drive lever ②
   - Pin ③
   - Collar ④
   - Clip ⑤



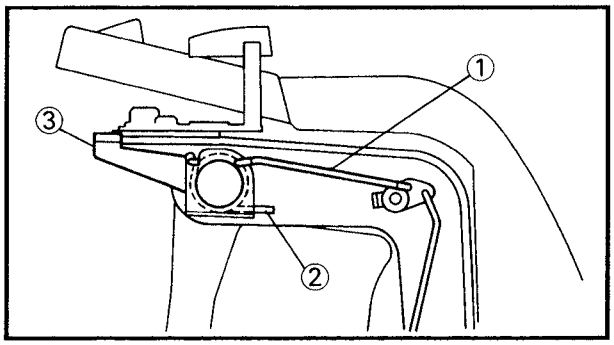
2. Install:
   - Spring ①
   - Tilt plate (inner) ②
   - Pin ③
   - Clip

NOTE:

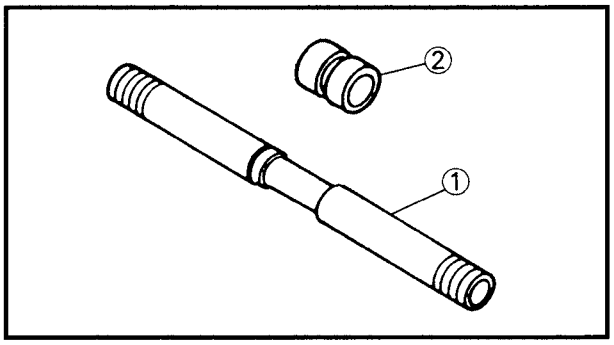
Align the holes of the tilt plate (inner and outer), after installing the pin.



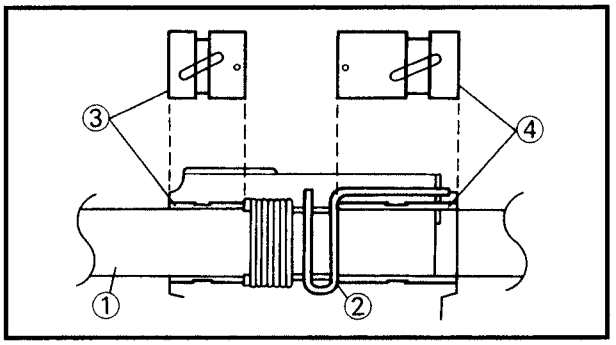
3. Install (T9.9/FT9.9A models)
   - Rod (long) ①
   - Rod (short) ②
   - Tilt lever ③
   - Pin
   - Clip



4. Install:
   - Rod (short) ①
   - Spring ②
   - Lever ③

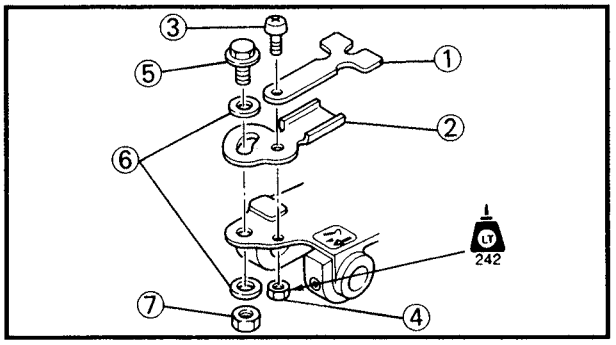


5. Install:
   - Clamp bolt ①
   - Bushing ②

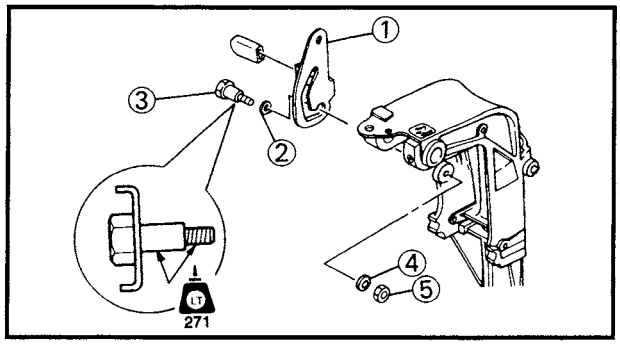


6. Install:
   - Clamp bolt ①
   - Lever ②
   - Bushing (short) ③
   - Bushing (long) ④

NOTE:
Install the bushings with the punch mark side inward.

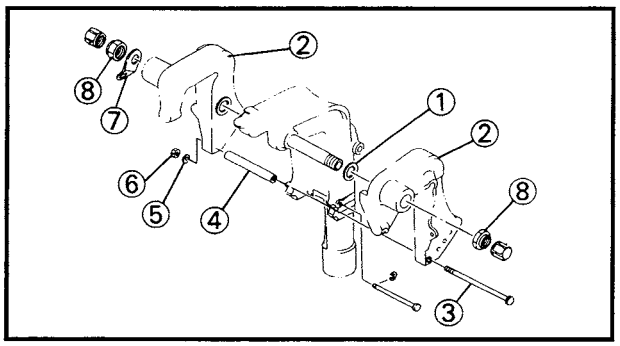


7. Install:
   - Plate ①
   - Control plate ②
   - Screw ③
   - Nut ④
   - Bolt ⑤
   - Washer ⑥
   - Nut ⑦



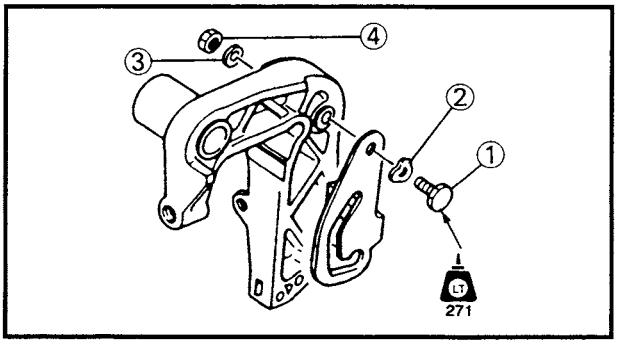
8. Install:
   - Lock plate ①
   - Washer ②
   - Bolt ③
   - Washer plate ④
   - Nut ⑤

	Nut: **12 Nm (1.2 m • kg, 8.7 ft • lb)**



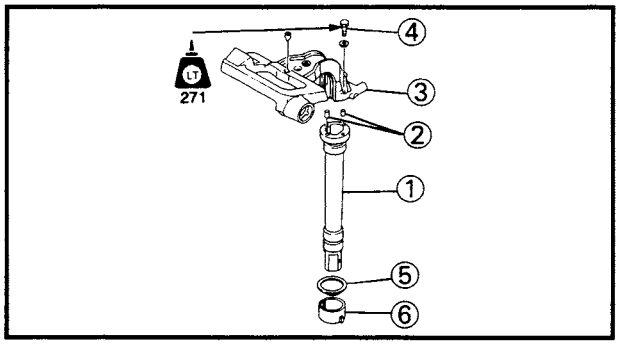
9. Install:
   - Washer ①
   - Clamp bracket ②
   - Bolt ③
   - Collar ④
   - Washer ⑤
   - Nut ⑥
   - Plate ⑦
   - Nut ⑧

	Nut (clamp bolt): **45 Nm (4.5 m • kg, 32.5 ft • lb)**

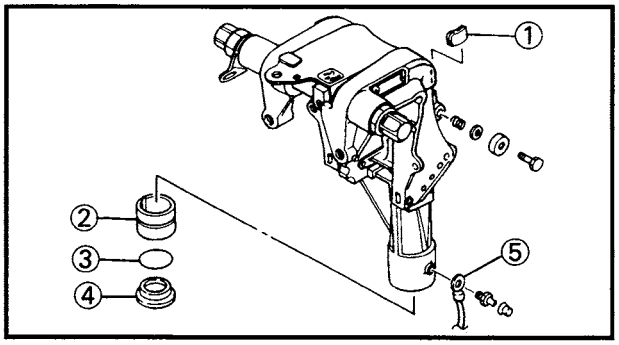


10. Install:
    - Bolt ①
    - Washer (wave) ②
    - Washer plate ③
    - Nut ④

11. Install:
    - Steering shaft ①
    - Pin ②
    - Steering bracket ③
    - Bolt ④
    - Washer ⑤
    - Bushing ⑥



	Bolt: **13 Nm (1.3 m • kg, 9.4 ft • lb)**



12. Install:
    - Friction piece ①
    - Bushing ②
    - O-ring ③
    - Bushing ④
    - Ground lead ⑤

K16050-0

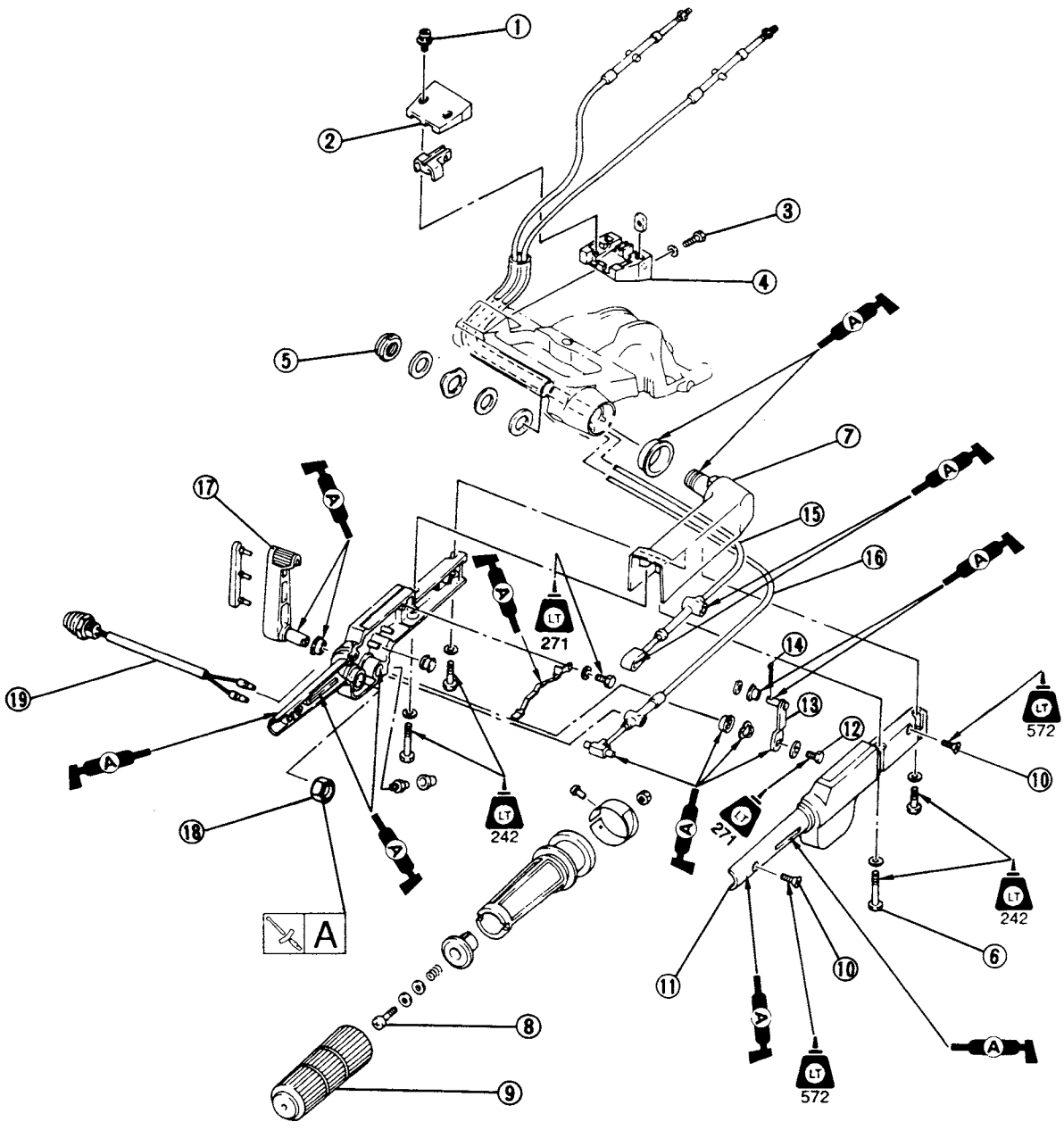
STEERING HANDLE

PREPARATION FOR REMOVAL

(T9.9/FT9.9A F8B, F9.9/F9.9B for Europe and Canada)

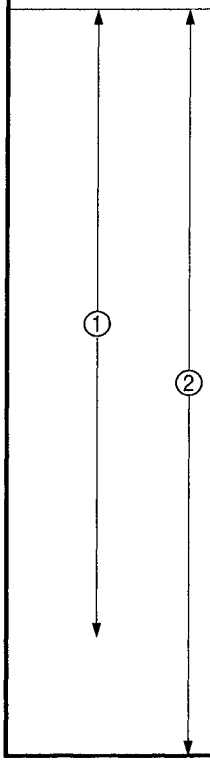
* Disconnect the control cables at engine side.
* Disconnect the wire leads.

A	4 Nm (0.4 m • kg, 2.9 ft • lb)



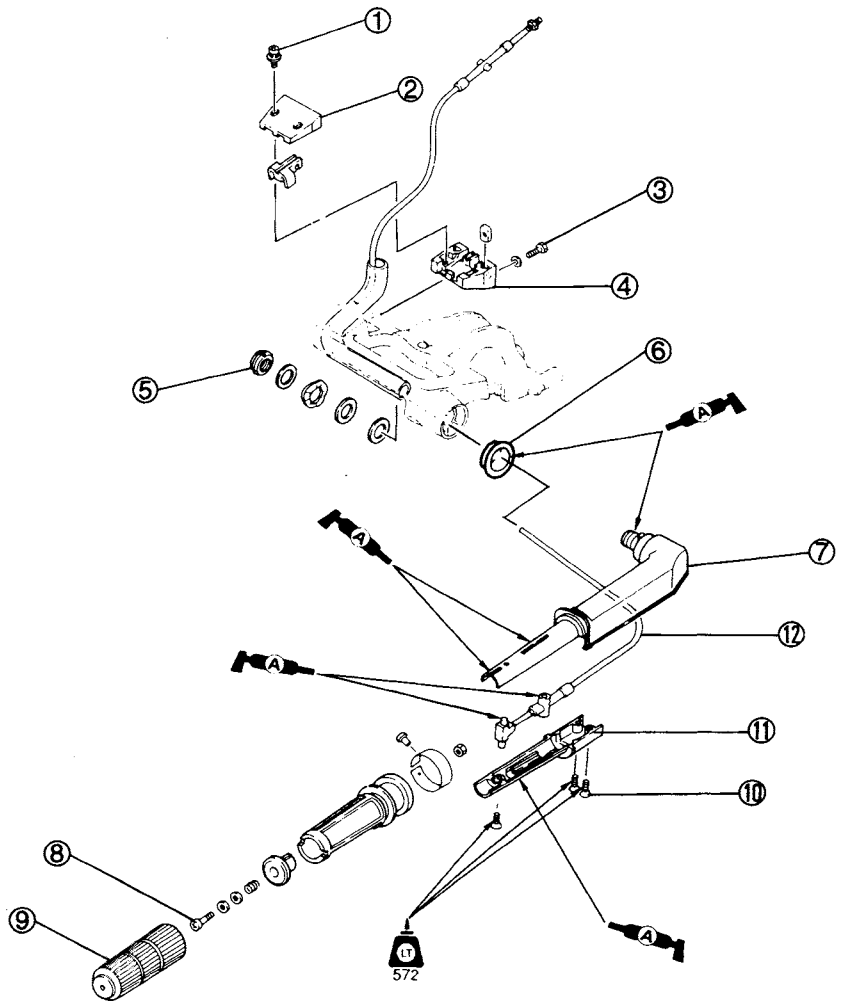
STEERING HANDLE

Extent of removal: ① Cable removal ② Steering handle disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
	1	Screw	2	
	2	Fitting plate	1	
	3	Bolt	2	
	4	Bracket	1	
	5	Ring nut	1	Refer to "REMOVAL POINTS".
	6	Bolt	4	
	7	Steering handle	1	
	8	Screw	1	
	9	Handle grip	1	
	10	Screw	2	
	11	Steering handle (left)	2	
	12	Bolt	1	
	13	Shift arm	1	
	14	Cotter pin	1	
	15	Shift cable	1	
	16	Throttle cable	1	
	17	Shift lever	1	
	18	Nut	1	
	19	Stop switch	1	

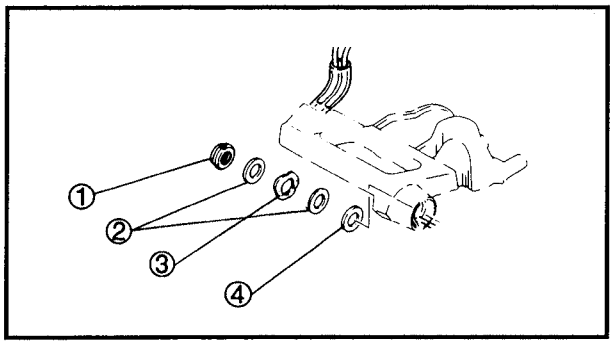
PREPARATION FOR REMOVAL (F9.9/F9.9B except for Europe and Canada)

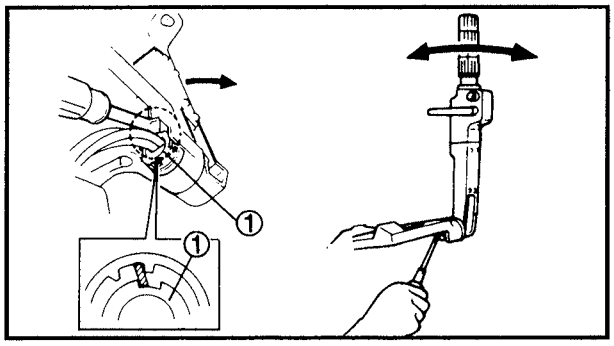
* Disconnect the control cables at engine side.

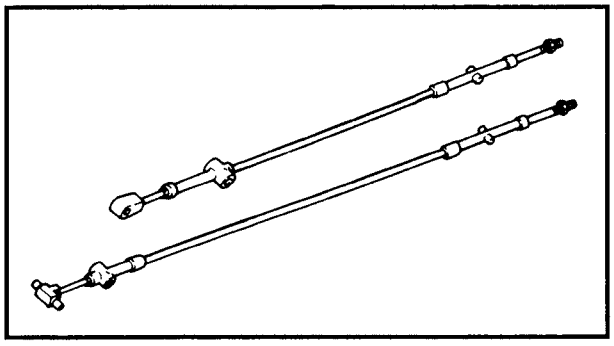


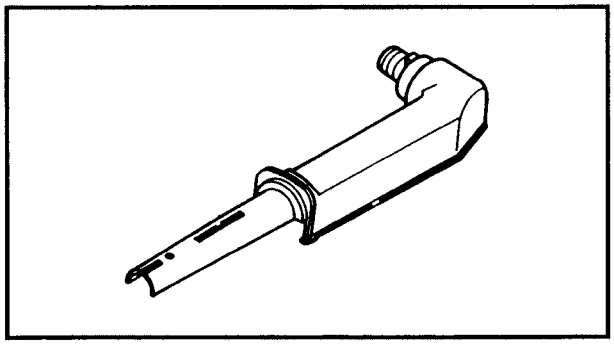
Extent of removal: ① Cable removal and Steering handle disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
①	1	Screw	2	
	2	Fitting plate	1	
	3	Bolt	2	
	4	Bracket	1	
	5	Ring nut	1	Refer to "REMOVAL POINTS".
	6	Bushing	1	
	7	Steering handle 1	1	
	8	Screw	1	
	9	Handle grip	1	
	10	Screw	3	
	11	Steering handle 2	1	
	12	Throttle cable	1	









REMOVAL POINTS

RING NUT

1. Remove:
   - Ring nut ①
   - Washer ②
   - Washer (wave) ③
   - Washer (nylon) ④

NOTE:

- Turn the steering handle backward.
- Fit a standard-head screwdriver into the slit in the ring nut.
- Set the screwdriver using the steering bracket as a fulcrum.
- Turn steering handle forward and loosen the ring nut.
- Repeat this operation until the ring nut comes off.

INSPECTION

SHIFT AND THROTTLE CABLES

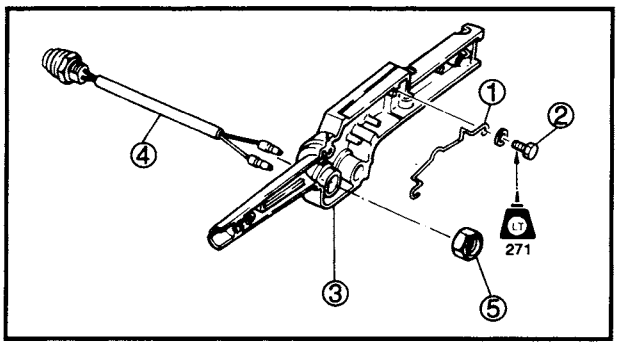
1. Inspect:
   - Shift cable
   - Throttle cable

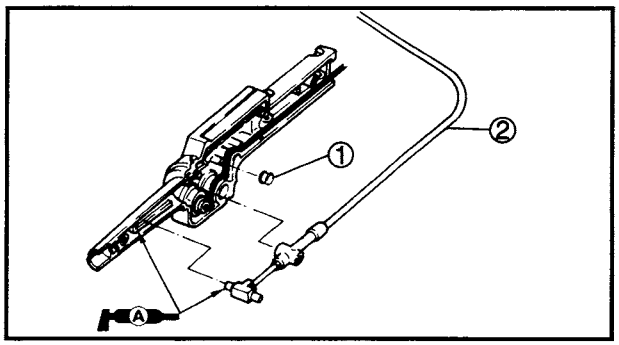
   Bend/Damage → Replace.
   Unsmooth operation → Replace.

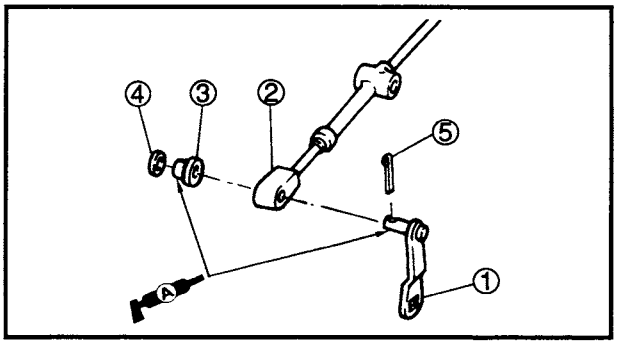
STEERING HANDLE

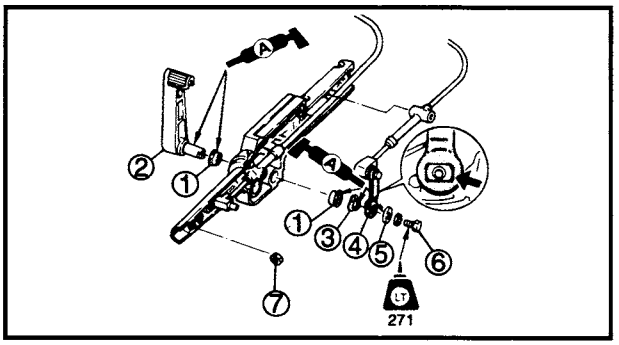
1. Inspect:
   - Steering handle

   Crack/Damage → Replace.









ASSEMBLY AND INSTALLATION

STEERING HANDLE (T9.9/FT9.9A, F8B, F9.9/F9.9B for Europe and Canada)

1. Install:
   - Spring ①
   - Bolt ②
   - Steering handle (right) ③
   - Stop switch ④
   - Nut ⑤

	Nut: **4 Nm (0.4 m • kg, 2.9 ft • lb)**

2. Install:
   - Grommet ①
   - Throttle cable ②

NOTE:

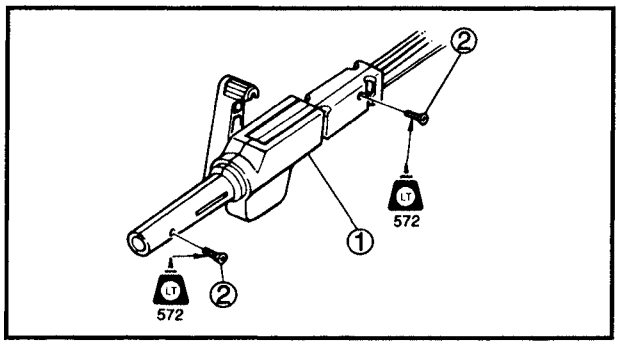
Fit the inner cable end in the groove, and fit the outer cable end into the hole.

3. Install:
   - Shift arm ①
   - Shift cable ②
   - Collar ③
   - Washer ④
   - Cotter pin ⑤

4. Install:
   - Bushing ①
   - Shift lever ②
   - Wave washer ③
   - Shift arm ④
   - Washer ⑤
   - Bolt ⑥
   - Nut ⑦

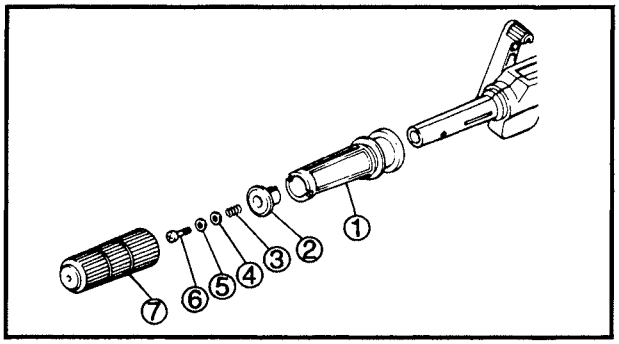
NOTE:

- Align the shift lever shaft end with the hole in the shift arm.
- Fit the shift arm collar to the Neutral position of the spring.



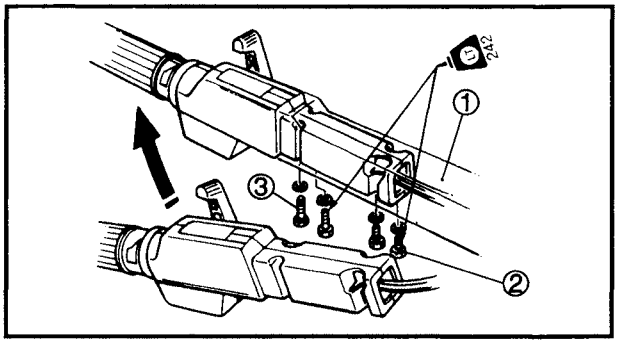
5. Install:
   - Steering handle (left) ①
   - Screw ②

NOTE:
- When installing steering handle, fit the throttle and shift cables correctly in place.
- After installing the steering handle, make sure that the shift lever operates correctly.

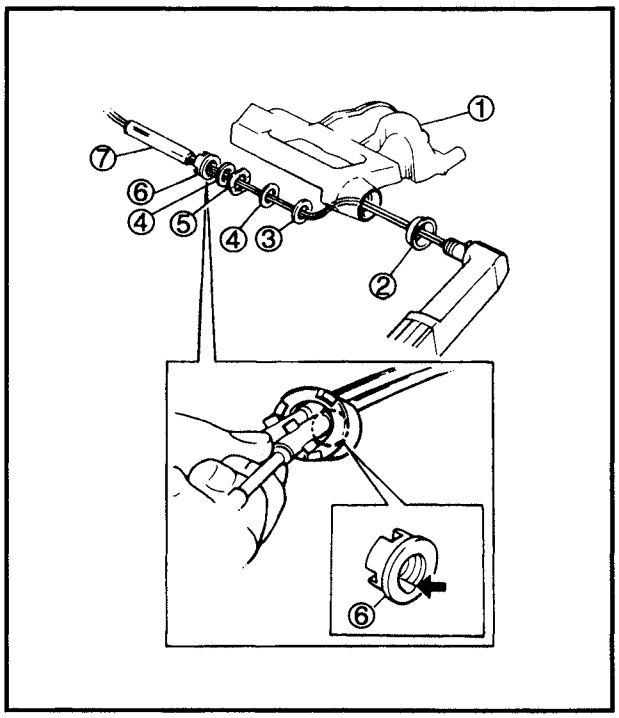


6. Install:
   - Steering grip ①
   - Friction piece ②
   - Spring ③
   - Washer ④
   - Washer (nylon) ⑤
   - Screw ⑥
   - Handle grip ⑦

NOTE:
Fit the handle grip correctly.

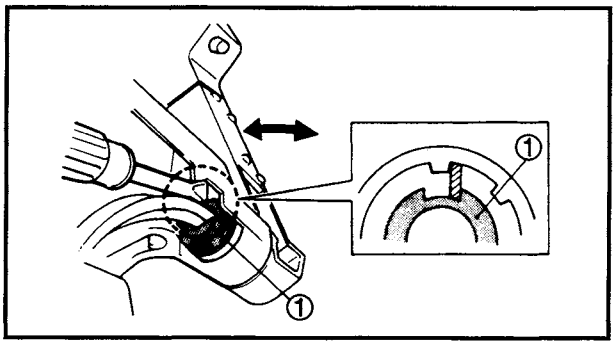


7. Install:
   - Steering handle ①
   - Bolt (short) ②
   - Bolt (long) ③



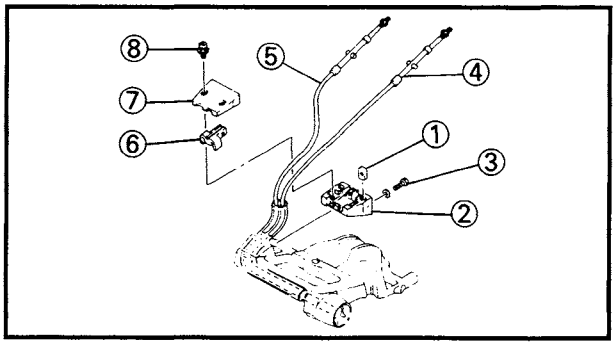
8. Install:
   - Steering bracket ①
   - Bushing ②
   - Washer (nylon) ③
   - Washer ④
   - Wave washer ⑤
   - Ring nut ⑥
   - Tube ⑦

NOTE:
Pass the throttle and shift cables and stop switch leads through the steering handle on the steering bracket.



9. Tighten:
   - Ring nut ①

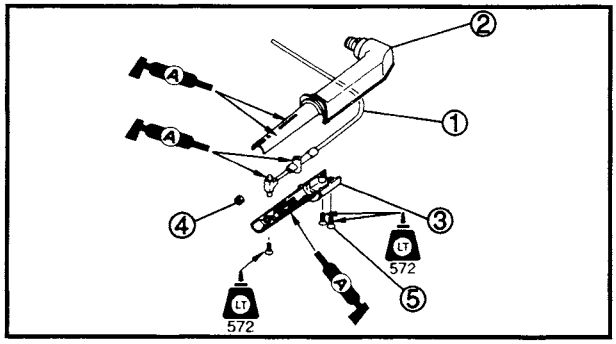
NOTE:
Screw in the ring nut by hand until tight and fit a slotted-head screwdriver into the slit in the ring nut. Lock the screwdriver with the steering bracket and tighten the ring nut by moving the steering handle back and forth.



10. Install:
    - Nut ①
    - Bracket ②
    - Bolt ③
    - Shift cable ④
    - Throttle cable ⑤
    - Stopper bracket ⑥
    - Fitting plate ⑦
    - Screw ⑧

NOTE:
When installing the shift cable, set the shift lever in the forward position.

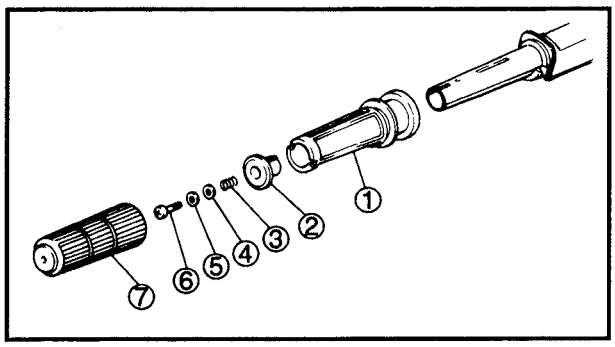
11. Adjust:
    - Throttle cable length
      Refer to page 3-15.



STEERING HANDLE
(F9.9/F9.9B except for Europe and Canada)

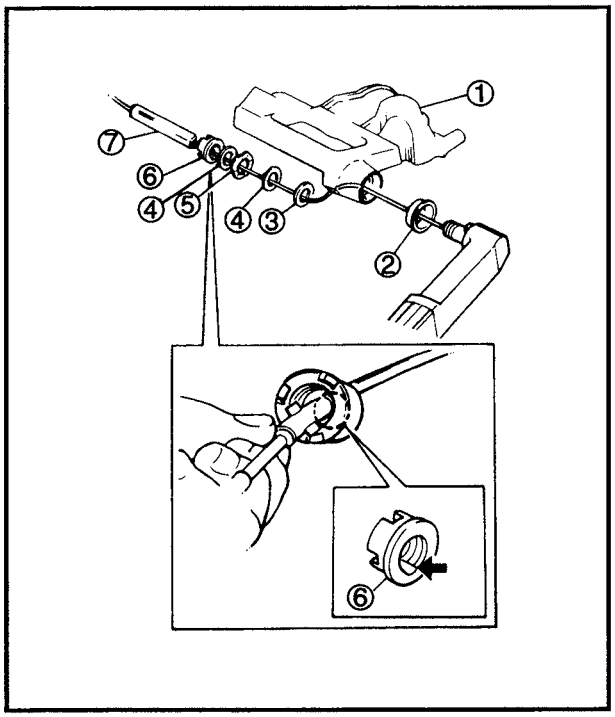
1. Install:
   - Throttle cable ①
   - Steering handle (upper) ②
   - Steering handle (under) ③
   - Nut ④
   - Screw ⑤

NOTE:
Fit the inner cable end in the groove and fit the outer cable end into the hole.



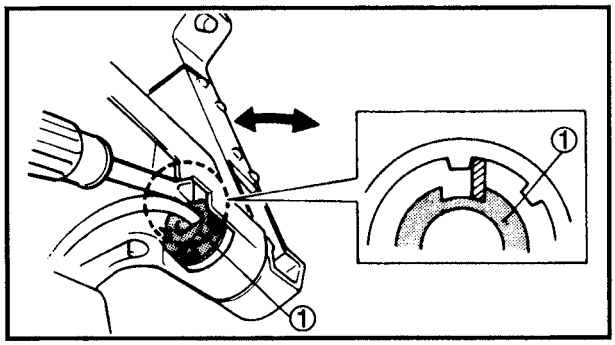
2. Install:
   - Steering grip ①
   - Friction piece ②
   - Spring ③
   - Washer ④
   - Washer (nylon) ⑤
   - Screw ⑥
   - Handle grip ⑦

NOTE:
Fit the handle grip correctly.



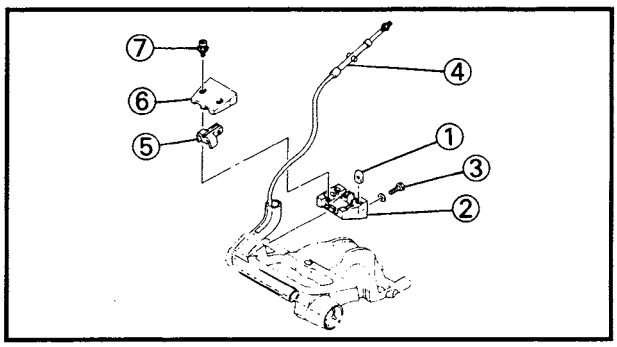
3. Install:
   - Steering bracket ①
   - Bushing ②
   - Washer (nylon) ③
   - Washer ④
   - Wave washer ⑤
   - Ring nut ⑥
   - Tube ⑦

NOTE:
Pass the throttle cable through the steering handle on the steering bracket.



4. Tighten:
   - Ring nut ①

NOTE:
Screw in the ring nut by hand until tight and fit a slotted-head screwdriver into the slit in the ring nut. Lock the screwdriver with the steering bracket and tighten the ring nut by moving the steering handle back and forth.



5. Install:
   - Nut ①
   - Bracket ②
   - Bolt ③
   - Throttle cable ④
   - Stopper bracket ⑤
   - Fitting plate ⑥
   - Screw ⑦
6. Adjust:
   - Throttle cable length
     Refer to page 3-15.

CHAPTER 8
ELECTRICAL SYSTEM

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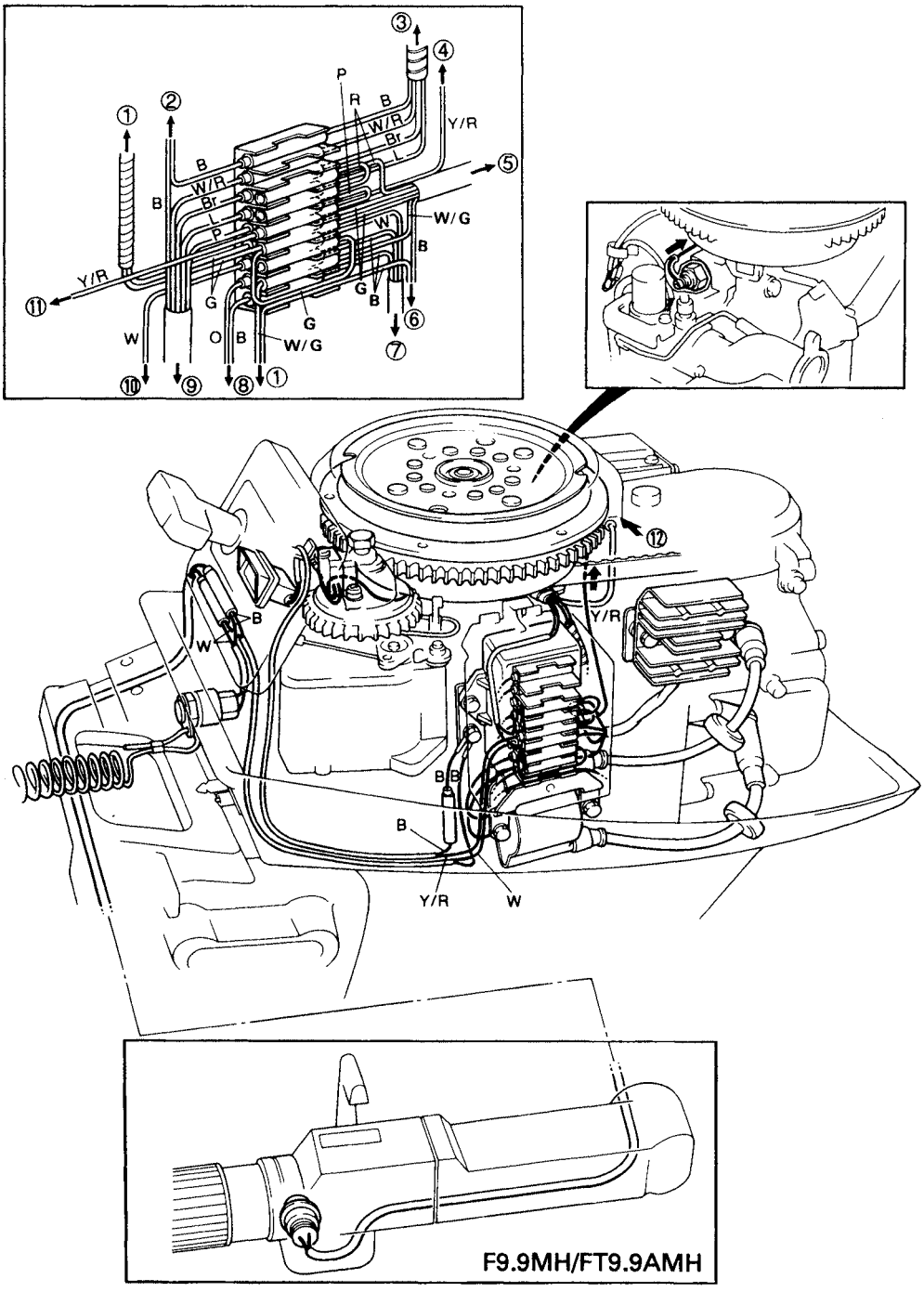
ELECTRICAL COMPONENTS
MANUAL STARTER MODEL

① Lighting coil
② Ground
③ Pulser coil/Charge coil
④ Oil-pressure switch
⑤ Rectifier regulator
⑥ Ground
⑦ CDI unit
⑧ Ignition coil
⑨ CDI unit
⑩ Engine stop switch
⑪ Oil-pressure indicator-lamp
⑫ Electrothermal valve

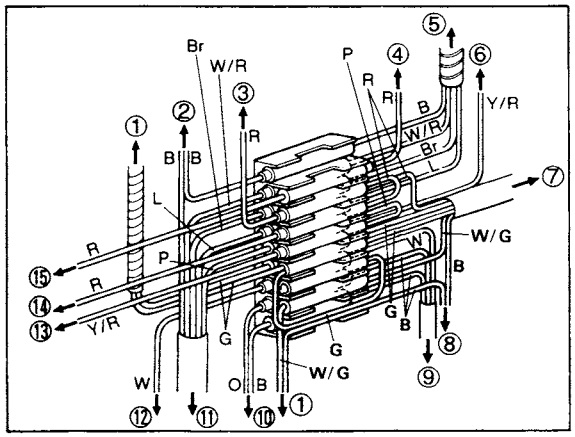
W/R : White/Red
Br : Brown
L : Blue
B : Black
W : White
P : Pink
Y/R : Yellow/Red
G : Green
O : Orange
G/W : Green/White
R : Red

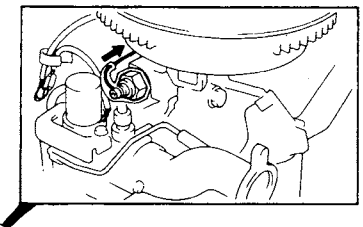


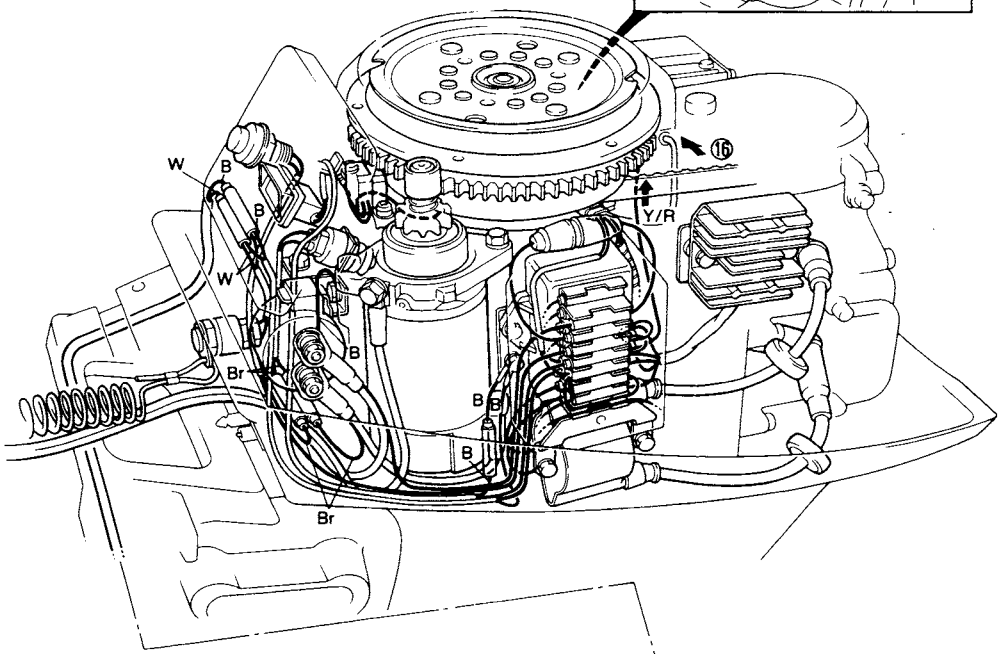
ELECTRICAL STARTER MODEL

① Lighting coil
② Ground
③ Fuse holder
④ Fuse holder
⑤ Pulser coil/Charge coil
⑥ Oil-pressure switch
⑦ Rectifier regulator
⑧ Ground
⑨ CDI unit
⑩ Ignition coil
⑪ CDI unit
⑫ Engine stop switch
⑬ Oil-pressure indicator-lamp
⑭ Starter-switch
⑮ Starter relay
⑯ Electrothermal valve

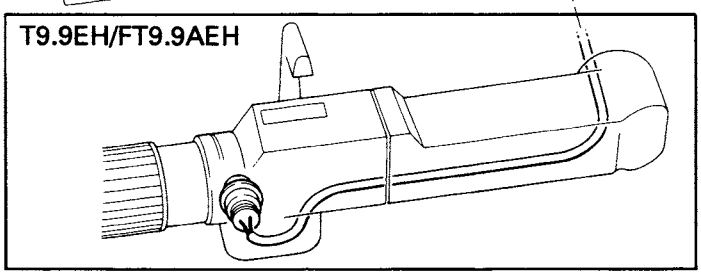
W/R : White/Red
Br : Brown
L : Blue
B : Black
W : White
P : Pink
Y/R : Yellow/Red
G : Green
O : Orange
G/W : Green/White
R : Red
B/W : Black/White







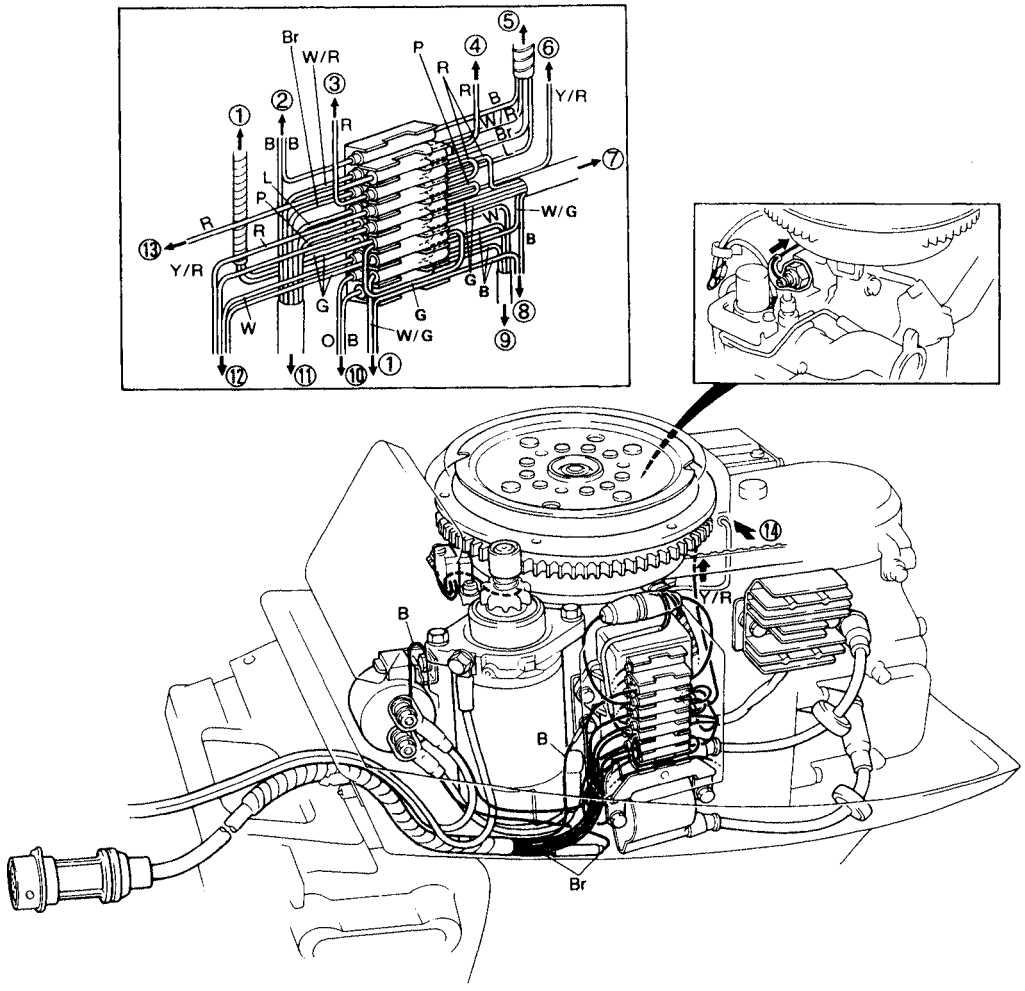
T9.9EH/FT9.9AEH



REMOTE CONTROL MODELS T9.9ER/FT9.9AE

① Lighting coil
② Ground
③ Fuse holder
④ Fuse holder
⑤ Pulser coil/Charge coil
⑥ Oil-pressure switch
⑦ Rectifier regulator
⑧ Ground
⑨ CDI unit
⑩ Ignition coil
⑪ CDI unit
⑫ Wiring-harness
⑬ Starter relay
⑭ Electrothermal valve

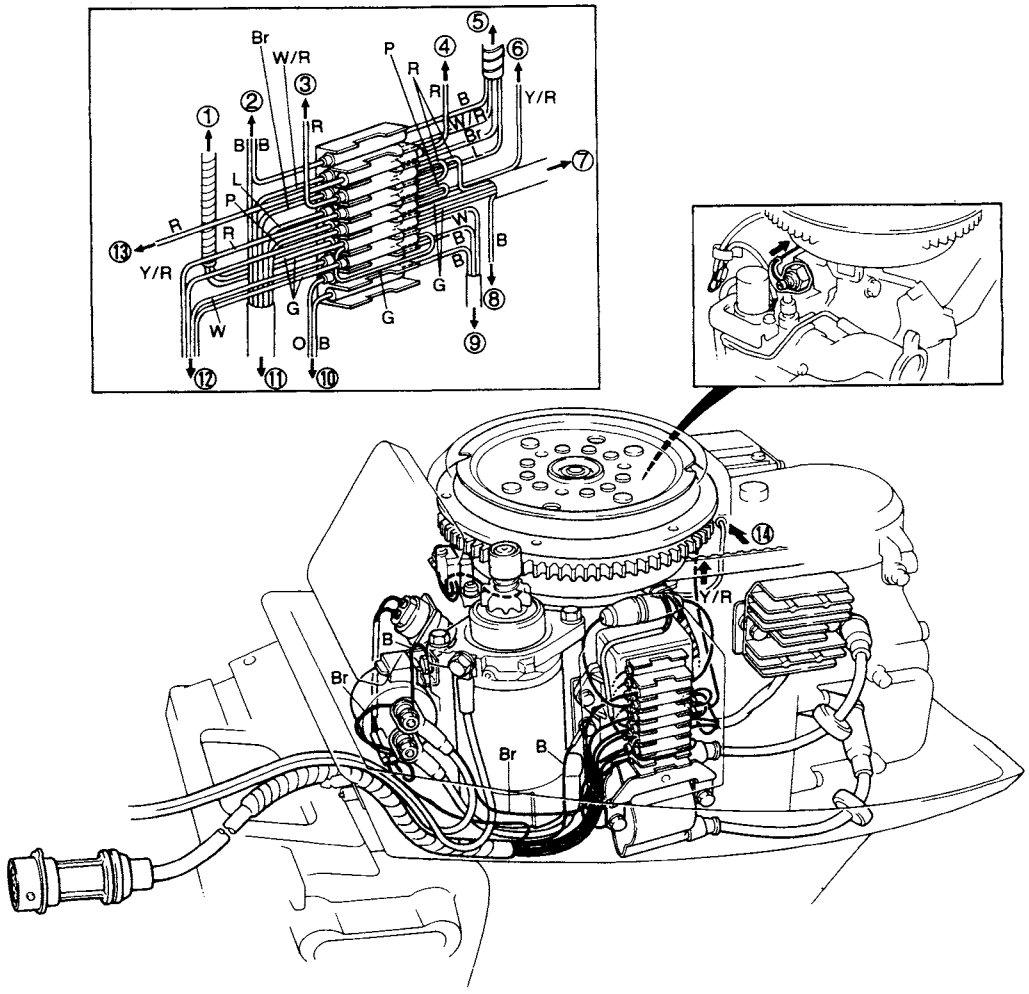
W/R	: White/Red	G/W	: Green/White
Br	: Brown	R	: Red
L	: Blue	B/W	: Black/White
B	: Black	Y	: Yellow
W	: White		
P	: Pink		
Y/R	: Yellow/Red		
G	: Green		
O	: Orange		



REMOTE CONTROL MODELS F8BE, F9.9BE

① Lighting coil
② Ground
③ Fuse holder
④ Fuse holder
⑤ Pulser coil/Charge coil
⑥ Oil-pressure switch
⑦ Rectifier regulator
⑧ Ground
⑨ CDI unit
⑩ Ignition coil
⑪ CDI unit
⑫ Wiring-harness
⑬ Starter relay
⑭ Electrothermal valve

W/R	: White/Red	G/W	: Green/White
Br	: Brown	R	: Red
L	: Blue	B/W	: Black/White
B	: Black	Y	: Yellow
W	: White		
P	: Pink		
Y/R	: Yellow/Red		
G	: Green		
O	: Orange		



ELECTRICAL ANALYSIS
INSPECTION

CAUTION:

All measuring instruments should be handled with special care or the correct measurement is impossible.
On an instrument powered by dry batteries, they should be checked for voltage periodically and replaced, if necessary.

NOTE:

" ○——○ " indicates the terminals between which there is a continuity of electricity; i.e., a closed circuit at the respective switch position.

Peak voltage measurement

NOTE:

- The coil output varies greatly at cranking speed.
- Proper readings cannot be found when cranking a cold engine with the spark plugs installed and with a weak battery.

Digital tester:
J-39299/90890-06752
Peak volt adapter:
YU-39991/90890-03169

Low resistance measurement

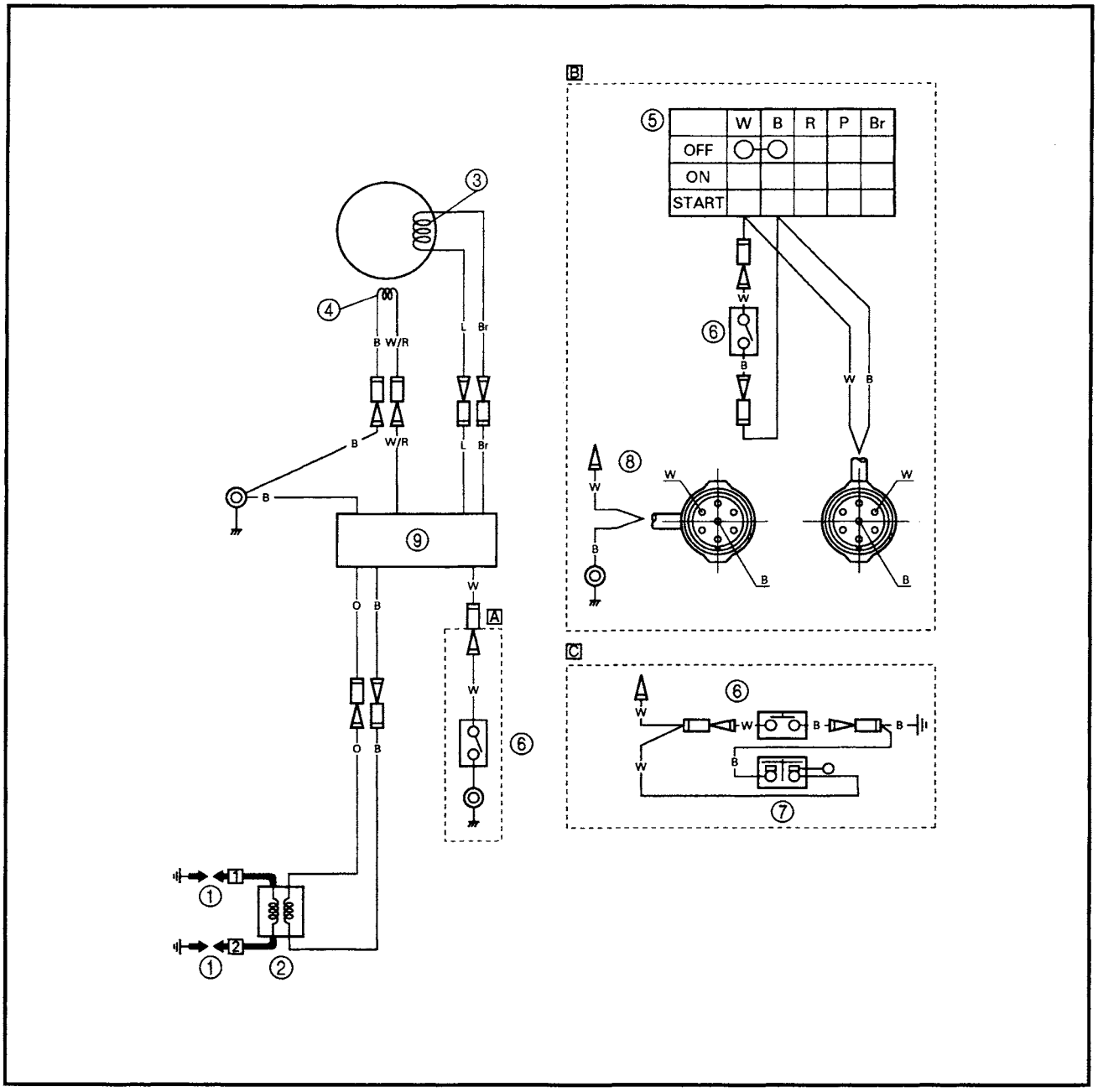
When measuring the resistance of 10 Ω or less using the digital tester, the correct measurement cannot be obtained because of the tester's internal resistance.
To obtain the correct value, subtract this internal resistance from the displayed measurement.

Correct value =
Displayed measurement –
Internal resistance

NOTE:

The internal resistance of the tester can be obtained by connecting both of its terminals.

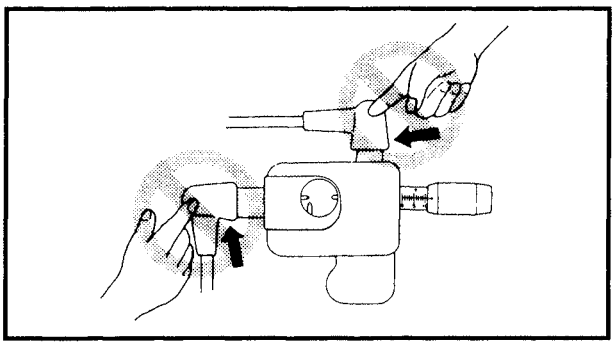
IGNITION SYSTEM
WIRING DIAGRAM

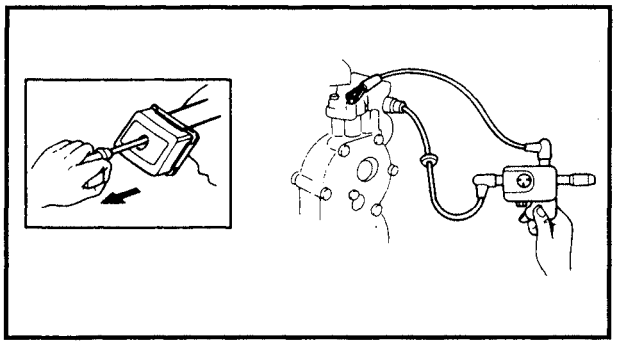


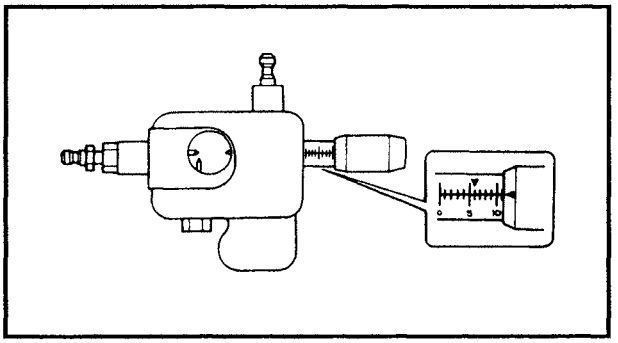
① Spark plug
② Ignition coil
③ Charge coil
④ Pulser coil
⑤ Main switch
⑥ Stop switch
⑦ Engine stop switch
⑧ 7P coupler
⑨ CDI unit

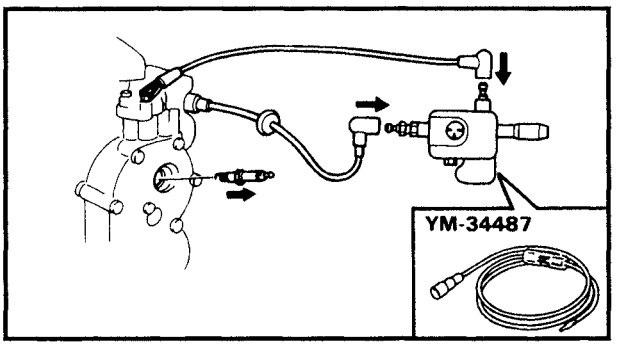
[A] Except for remote control model
[B] For remote control model
[C] T9.9MH/FT9.9AMH, T9.9EH/FT9.9AEH

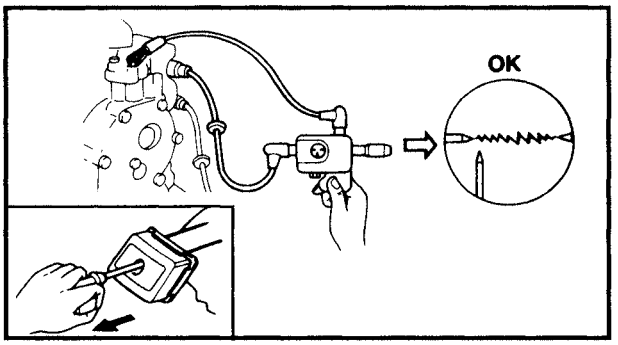
Br : Brown
L : Blue
W/R : White/Red
B/O : Black/Orange
B/W : Black/White
W : White
B : Black











IGNITION SPARK GAP

⚠ WARNING

- **While checking the spark gap, be careful not to touch any connection of lead wires of the "Ignition spark gap tester".**
- **When doing the spark test, take special care not to allow leakage from the removed plug cap.**
- **This check is likely to produce sparks, so be sure that no flammable gas or fluid is in the vicinity.**

1. Check:
   - Ignition spark gap
     Out of specification → Peak voltage measurement.

Spark gap:
9 mm (0.35 in)

Checking steps:
- Adjust the spark gap to specification by turning the adjusting knob.

Spark gap tester:
YM-34487/90890-06754

- Connect the spark-plug cap to the spark gap tester.
- Remove the spark plugs from the engine.
- Crank the engine and check the spark gap through the discharge window.

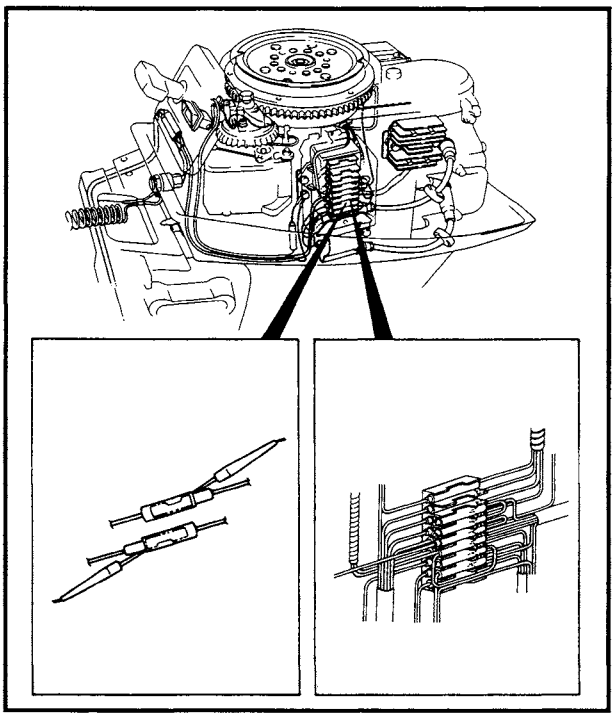
CDI SYSTEM PEAK VOLTAGE

⚠ WARNING

While taking a CDI unit check be careful not to touch any connection of lead wires.

NOTE:

- If there is no spark or the spark is weak, continue with the CDI test.
- If a good spark is obtained, the problem is not with the CDI system, but possibly the spark plug or another component is defective.



1. Measure:
   - CDI unit output (test #1)
     Below specification → Replace ignition coil.

T9.9/FT9.9A

CDI output peak voltage: (minimum) (O – B)

r/min	Cranking		1,500	3,500
	Open	Connect		
V	95	90	205	195

F8B, F9.9/F9.9B

CDI output peak voltage: (minimum) (O – B)

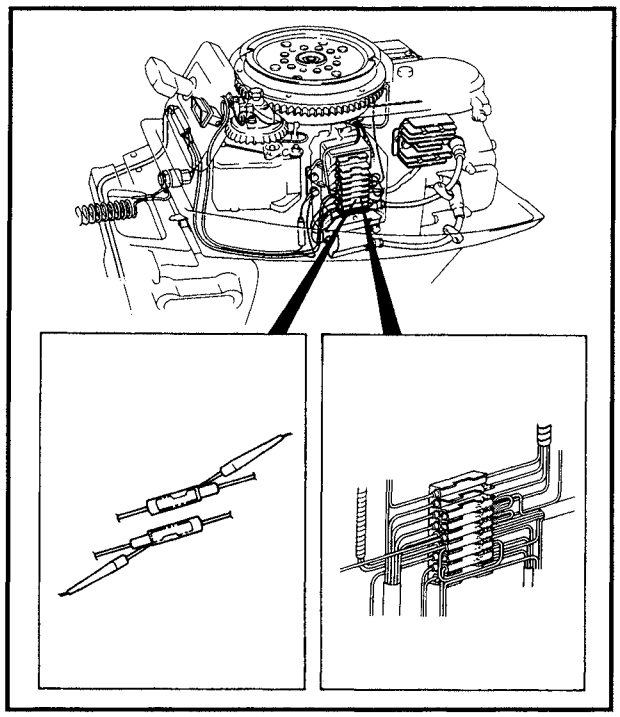
r/min	Cranking		1,500	3,500
	Open	Connect		
V	85	85	195	170

Measurement steps:

- Connect the tester to the CDI unit as shown.
- Set the tester dial to specification.

Range:
⎓ V

- Crank or start the engine.



2. Measure:
   - Charge coil output (test #2)
     Below specification → Replace charge coil.

T9.9/FT9.9A

Charge coil output peak voltage: (minimum) (Br – L)

r/min	Cranking		1,500	3,500
	Open	Connect		
V	100	150	220	210

F8B, F9.9/F9.9B

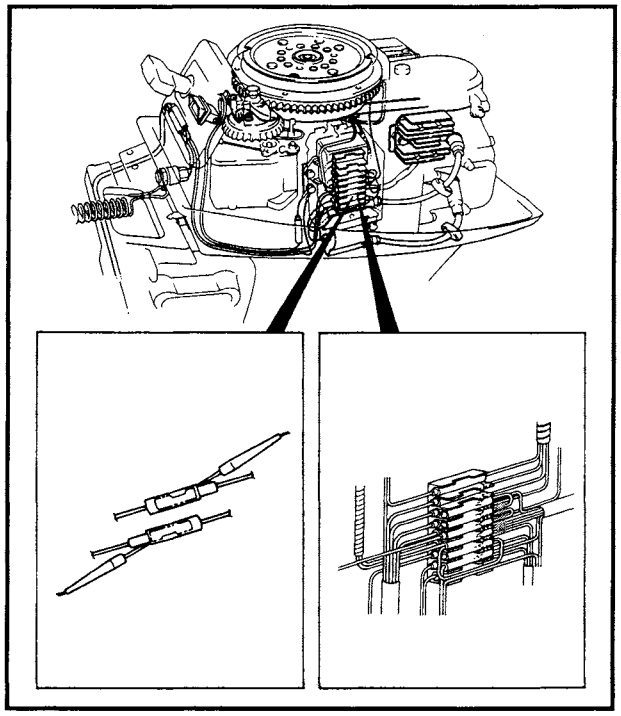
Charge coil output peak voltage: (minimum) (Br – L)

r/min	Cranking		1,500	3,500
	Open	Connect		
V	95	90	205	180

Measurement steps:
- Connect the tester to the charge coil as shown.
- Set the tester dial to specification.

Range:
V

- Crank or start the engine.



3. Measure:
   - Pulser coil output (test #3)
     Beyond specification → Replace CDI unit.
     Below specification → Replace pulser coil.

T9.9/FT9.9A

Pulser coil output peak voltage: (minimum) (W/R – B)

r/min	Cranking		1,500	3,500
	Open	Connect		
V	4.0	2.5	7.5	12.0

F8B, F9.9/F9.9B

Pulser coil output peak voltage: (minimum) (W/R – B)

r/min	Cranking		1,500	3,500
	Open	Connect		
V	3.5	2.5	7.5	13.0

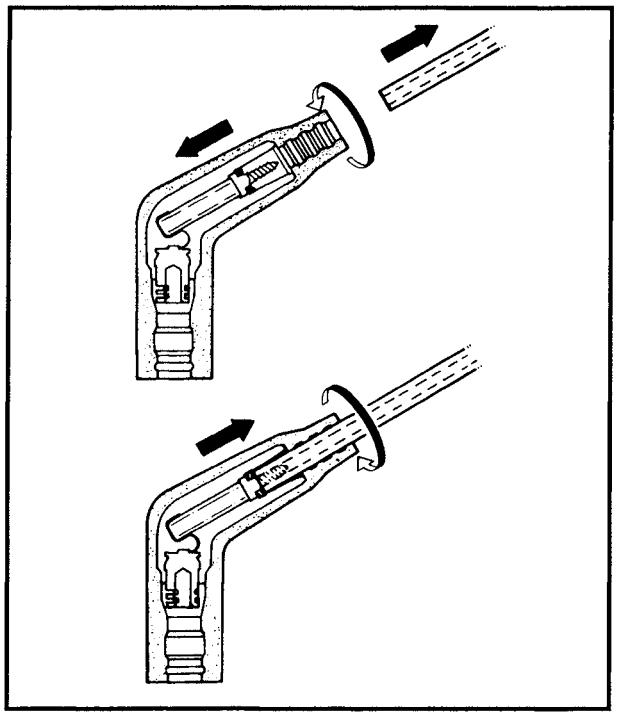
Measurement steps:
- Connect the tester to the pulser coil as shown.
- Set the tester dial to specification.

Range:
⎓ V

- Crank or start the engine.

SPARK PLUG

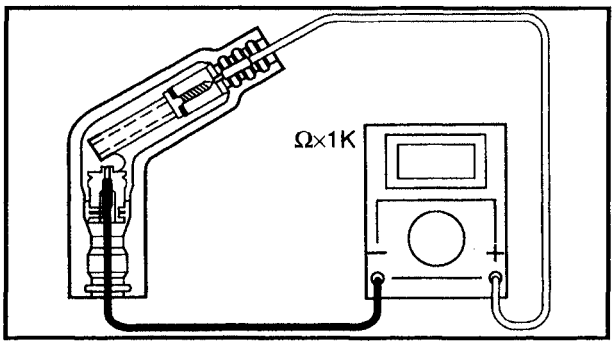
Refer to "PERIODIC SERVICE" in chapter 3.



SPARK PLUG CAP

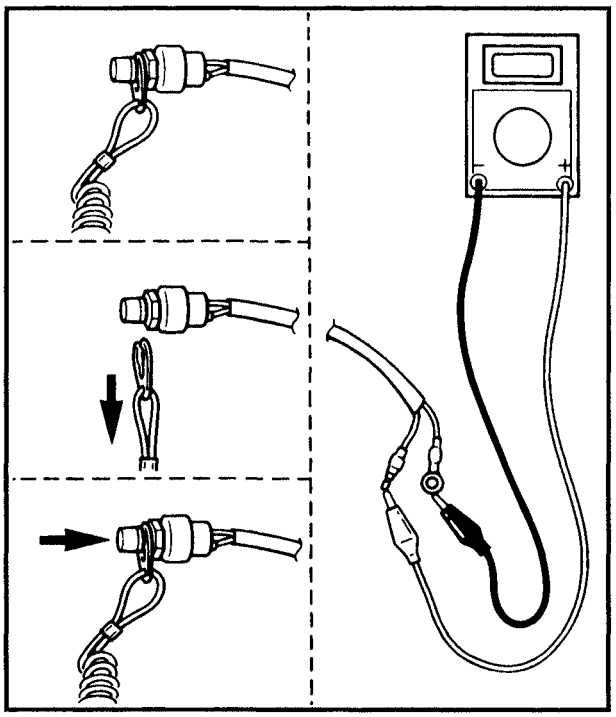
1. Inspect:
   - Spark plug cap
     Loosen → Tighten.
     Crack/Damage → Replace.

Replacement steps:
- Remove the spark-plug cap by turning the cap counterclockwise.
- Install the spark-plug cap by turning the cap clockwise until it stops.



2. Measure: (For Canada and Europe)
   - Spark plug cap resistance
     Out of specification → Replace.

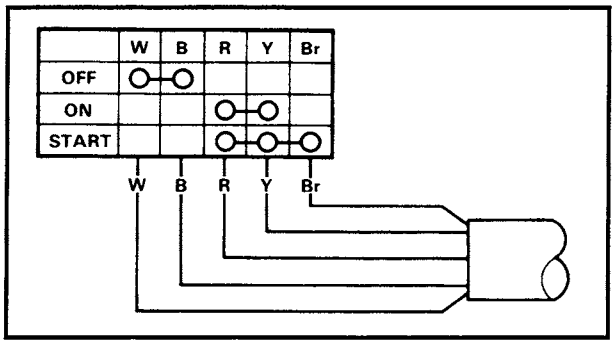
Spark plug cap resistance:
4.0 ~ 6.0 kΩ



ENGINE STOP SWITCH

1. Check:
   - Continuity
     Out of specification → Replace.

		Leads color	
		White	Black
T9.9/ FT9.9A	Installed		
	Removed	○	○
F8B, F9.9/ F9.9B	Installed		
	Removed	○	○
	Install and depress the button	○	○

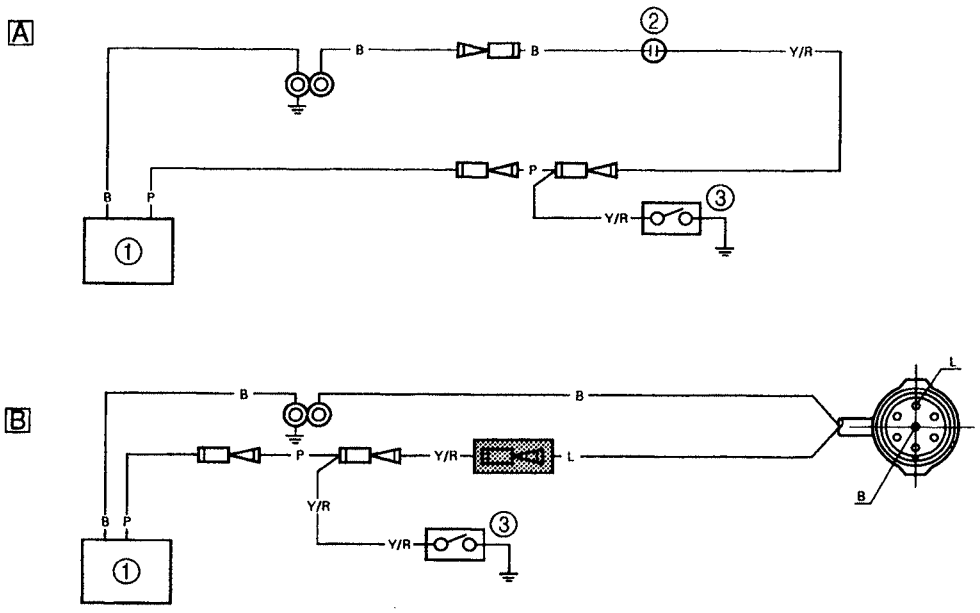


MAIN SWITCH

1. Check:
   - Continuity
     Out of specification → Replace.

	Leads color				
Switch position	White	Black	Red	Yellow	Brown
OFF	○—○				
ON			○—○		
START			○—○—○		

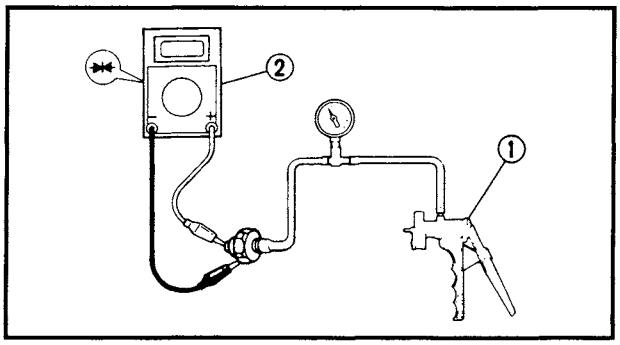
IGNITION CONTROL SYSTEM
WIRING DIAGRAM



① CDI unit
② Oil pressure indicator-lamp
③ Oil pressure switch

A Except for remote model
B For remote model

B : Black
L : Blue
P : Pink
Y/R : Yellow/Red



OIL PRESSURE SWITCH

1. Measure:
   - Continuity
     Out of specification → Replace.

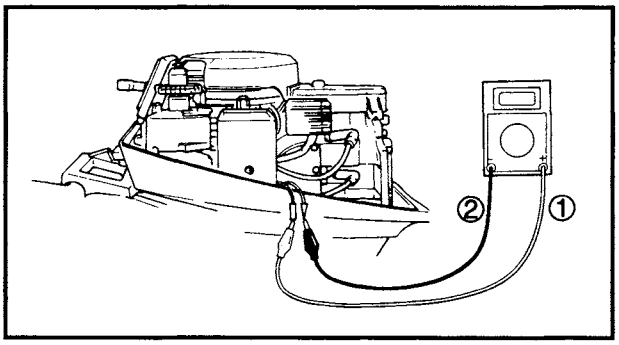
Measurement steps: ● Connect the Mity Vac ①. ● Connect the tester ②.	
	Mity Vac: **YB-35956/90890-06756**
● Apply the specified pressure.	

	Oil pressure switch:
0 ± 10 kPa **(0 ± 0.1 kg/cm², 0 ± 1.4 psi)**	**Continuity**
60 ± 1 0 kPa **(0.6 ± 0.1 kg/cm², 8.5 ± 1.4 psi)**	**Discontinuity**

OIL PRESSURE INDICATOR LAMP

1. Check:
   - Oil pressure indicator lamp operation
     Out of specification → Replace.

Checking steps: ● Connect the digital tester for engine side leads.
① **Pink lead → Positive terminal** ② **Black lead → Negative terminal**
● Start the engine. ● Check the voltage of output.
Output voltage: **More than AC 65V**
● Stop the engine. ● Connect the oil pressure indicator lamp to engine side leads. ● Start the engine. ● Check the oil pressure indicator lamp for green indication.



⚠ WARNING

Be careful not to touch the ignition system leads while performing testing. High voltage electric shock may cause injury.

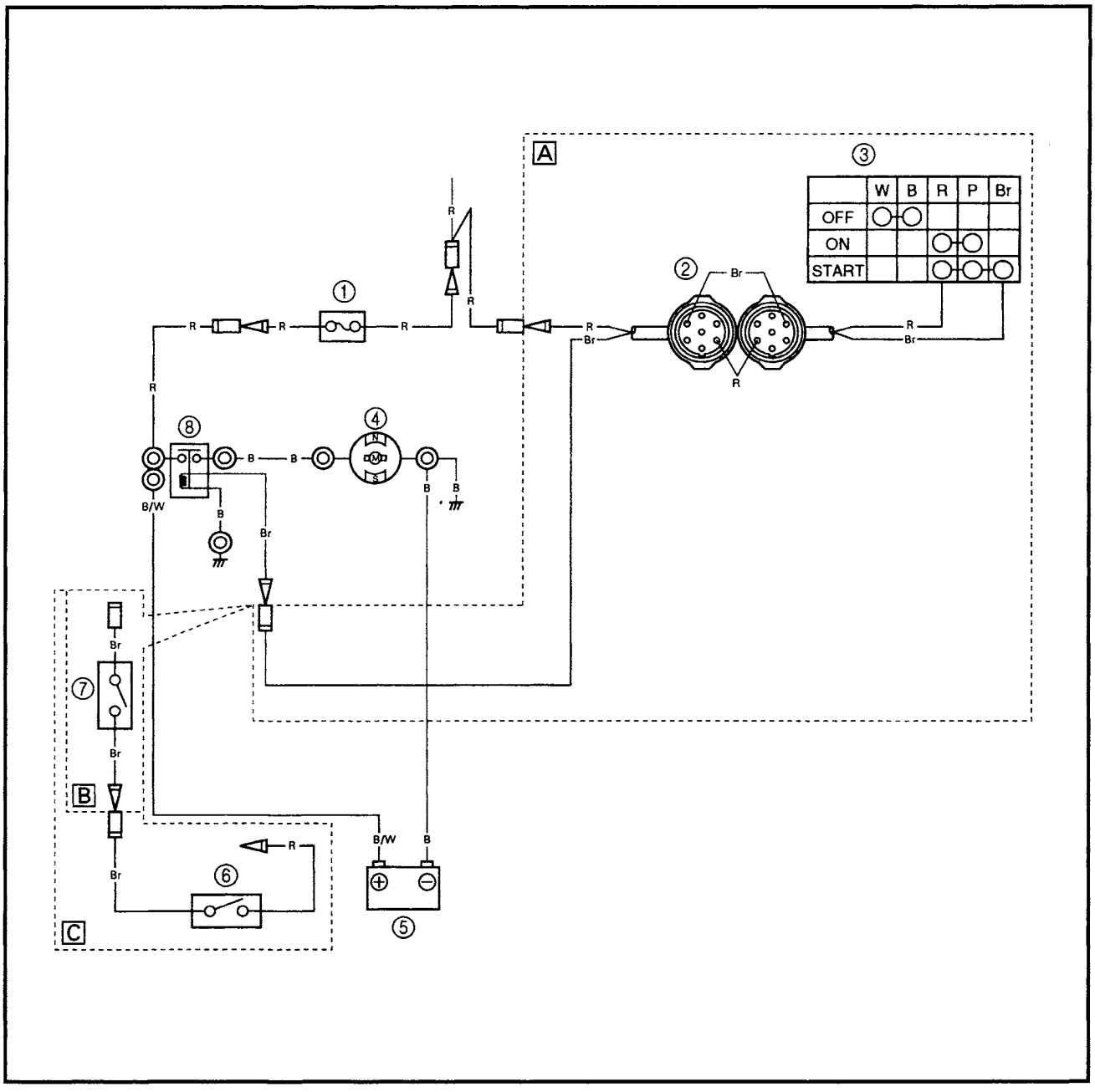
CAUTION:

Make the test with the motor placed in a test tank.

NOTE:

Before testing the oil pressure indicator lamp operation, oil pressure switch should be tested.

STARTING SYSTEM
WIRING DIAGRAM



① Fuse
② 7P coupler
③ Main switch
④ Starter motor
⑤ Battery
⑥ Starter switch
⑦ Neutral switch
⑧ Starter relay

A For remote control model
B For switch panel model
C Except for remote control model

B : Black
Br : Brown
R : Red

BATTERY

Refer to "PERIODIC SERVICE" in chapter 3.

FUSE

1. Check:
   - Fuse

   Blown → Replace.

	Fuse rating: **12V - 20 A**

WIRING HARNESS

1. Check:
   - Continuity

   Discontinuity → Replace.

WIRING CONNECTION

1. Check:
   - Wiring connection

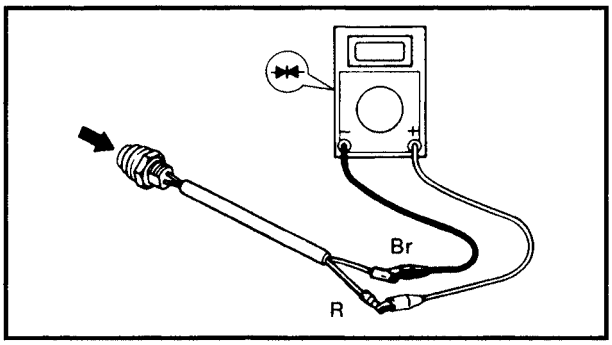
   Poor connection → Correct.

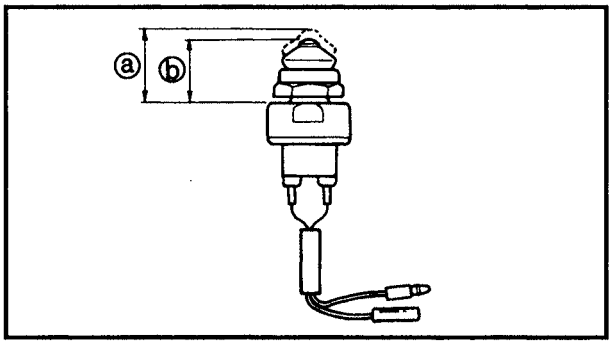
ENGINE STOP SWITCH

Refer to "IGNITION SYSTEM".

MAIN SWITCH

Refer to "IGNITION SYSTEM".





STARTER SWITCH

1. Check:
   - Continuity

   Out of specification → Replace.

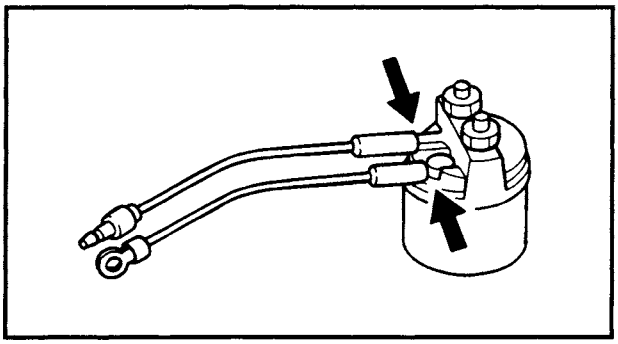
	Leads color	
	Red	**Brown**
Free		
Push	○	○

NEUTRAL SWITCH

1. Check:
   - Continuity

   Out of specification → Replace.

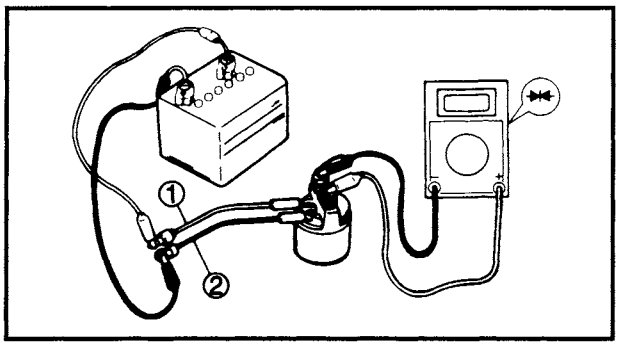
	Length	Leads color	
		Brown	**Brown**
Free ⓐ	**19.5 ~ 20.5 mm (0.77 ~ 0.81 in)**		
Push ⓑ	**18.5 ~ 19.5 mm (0.73 ~ 0.77 in)**	○	○



STARTER RELAY

1. Inspect:
   - Brown lead terminal
   - Black lead terminal

   Loose → Tighten.



2. Check:
   - Relay operation

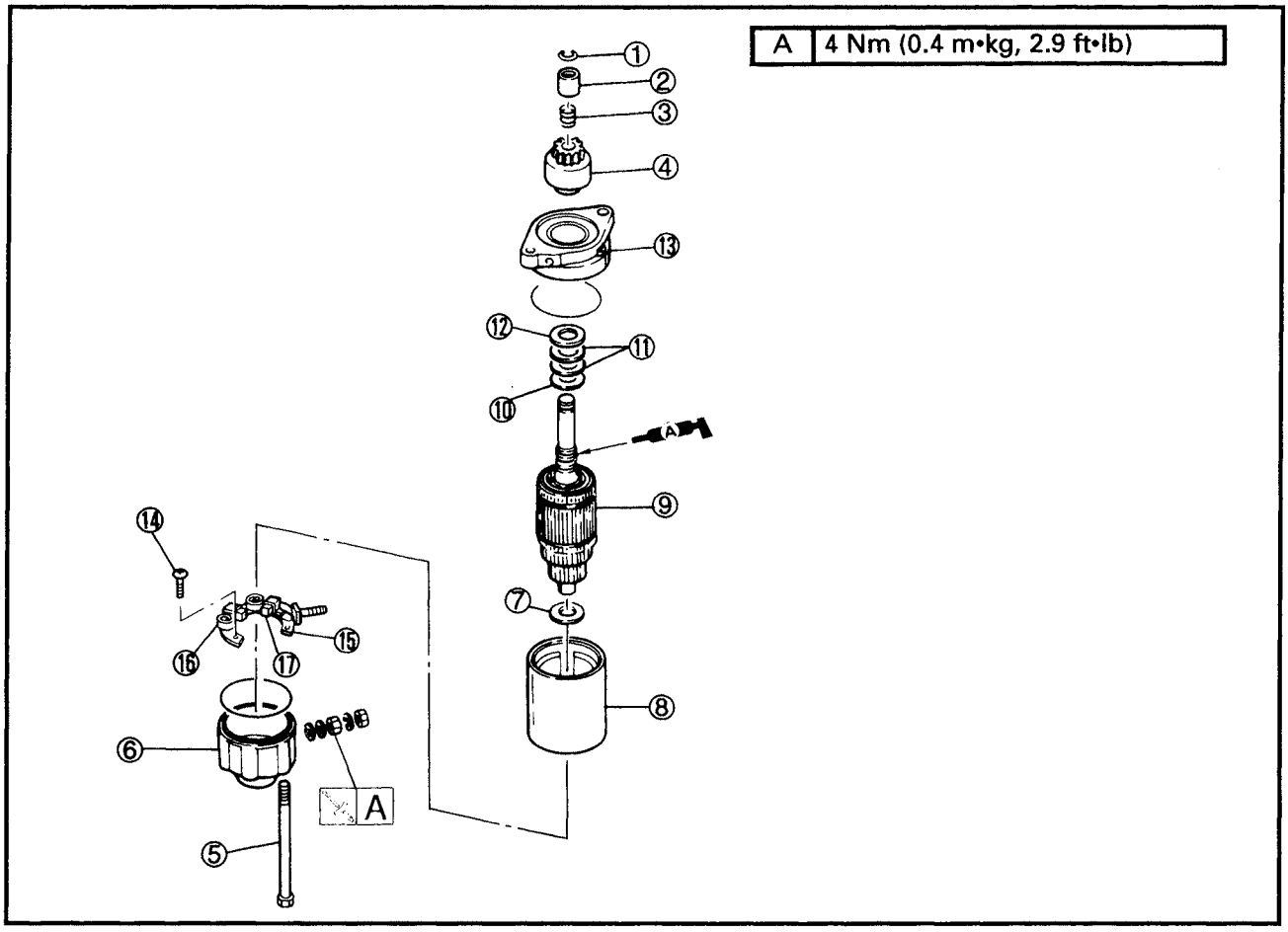
   Does not function → Replace.

Checking steps:
- Connect the tester between the terminals of the starter relay as shown.
- Connect a 12V battery.

Brown lead ① → Positive terminal
Black lead ② → Negative terminal

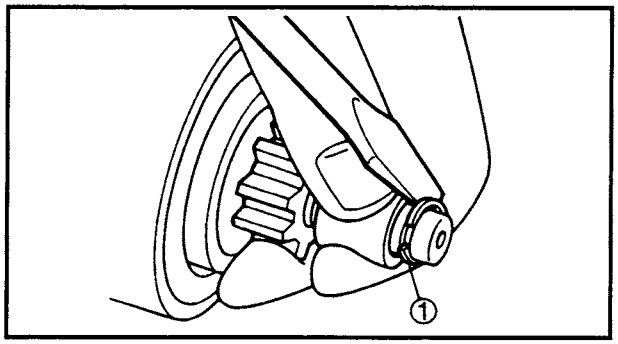
- Check that there is continuity between the starter relay terminals.

STARTER MOTOR



Extent of removal: ① Starter motor disassembly ② Brush disassembly

Extent of removal	Order	Part name	Q'ty	Remarks
①	1	Clip	1	Always use a new circlip
	2	Pinion stopper	1	Refer to "REMOVAL POINTS".
	3	Spring	1	
	4	Pinion	1	
②	5	Through bolt	2	
	6	Rear cover	1	
①	7	Washer	1	t = 0.25 mm
	8	Stator	1	
	9	Armature	1	
	10	Washer	1	t = 2.0 mm
	11	Washer	1	t = 0.15 mm
	12	Washer	1	t = 1.0 mm
	13	Front cover	1	
	14	Screw	1	
②	15	Brush holder	1	
	16	Brush spring	2	
	17	Brush	2	



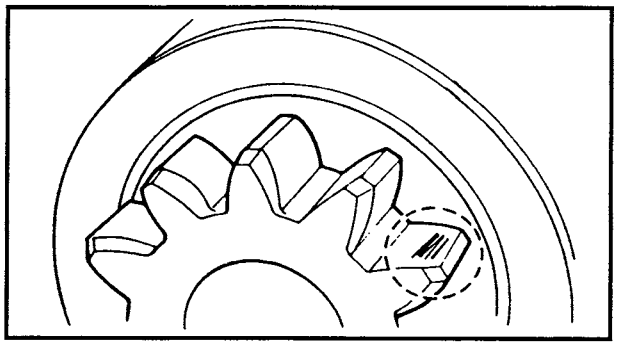
SERVICE POINTS

Pinion removal

1. Remove:
   - Clip ①

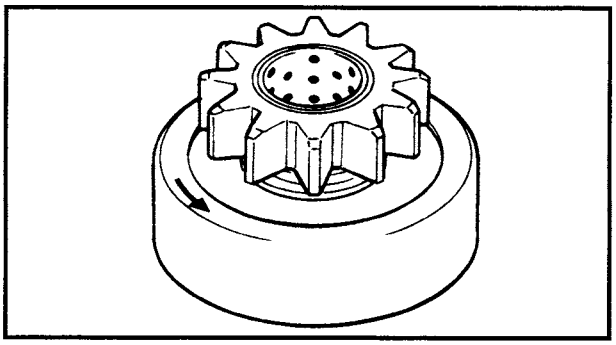
NOTE:

Using a pry-bar, pry off the clip.



Pinion inspection

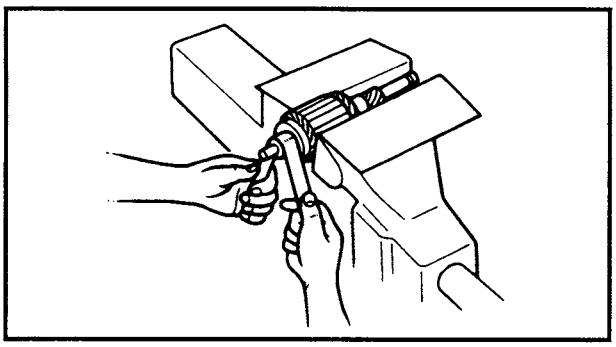
1. Inspect:
   - Pinion teeth
     Wear/Damage → Replace.



2. Check:
   - Clutch movement
     Damage → Replace.

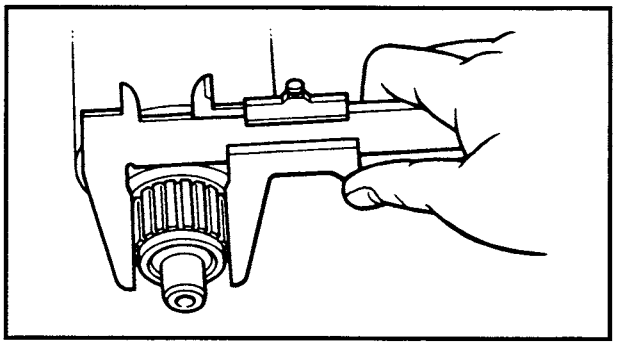
NOTE:

Rotate the pinion clockwise and check that it moves freely. Also, try to rotate the pinion counterclockwise and confirm that it locks.



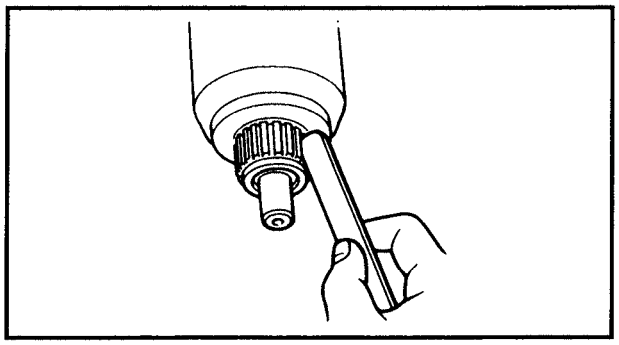
Armature inspection

1. Inspect:
   - Commutator
     Dirty → Clean with #600 abrasive paper.



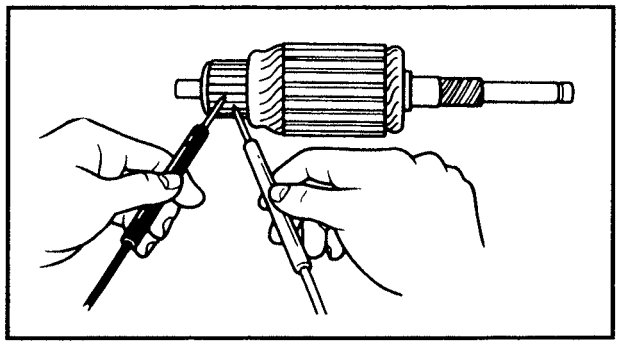
2. Measure:
   - Commutator diameter
     Out of specification → Replace.

	Commutator diameter: **29.0 ~ 30.0 mm (1.14 ~ 1.18 in)**



3. Check:
   - Commutator under cut
     Clog/Dirty → Clean.

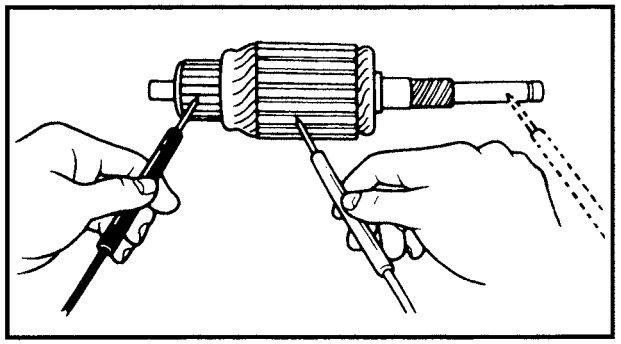
NOTE:
Remove all metal particles with compressed air.

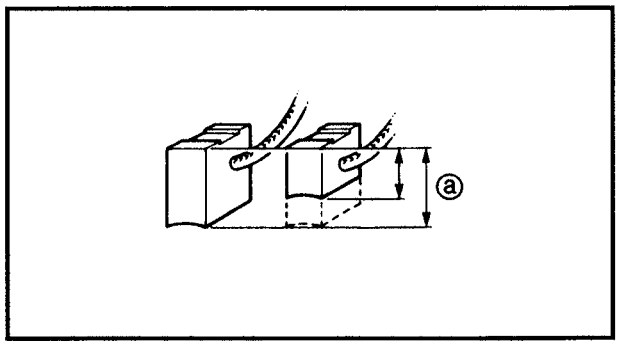


4. Inspect:
   - Armature coil continuity
     Out of specification → Replace.

Armature coil continuity:

Commutator segments	Continuity
Segment - Laminations	Discontinuity
Segment - Shaft	Discontinuity

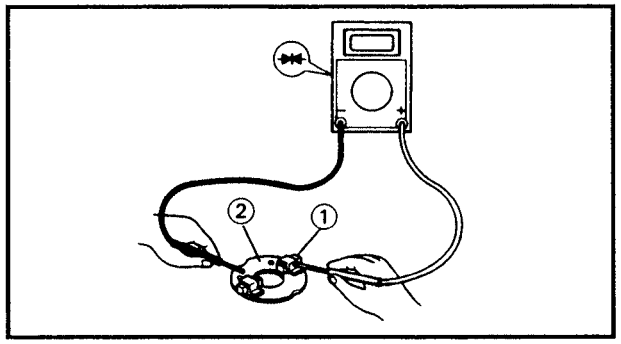




Brush holder inspection

1. Measure:
   - Brush length ⓐ
     Out of specification → Replace.

Brush length ⓐ:
9.0 ~ 12.5 mm (0.35 ~ 0.49 in)



2. Check:
   - Brush holder continuity
     Out of specification → Replace.

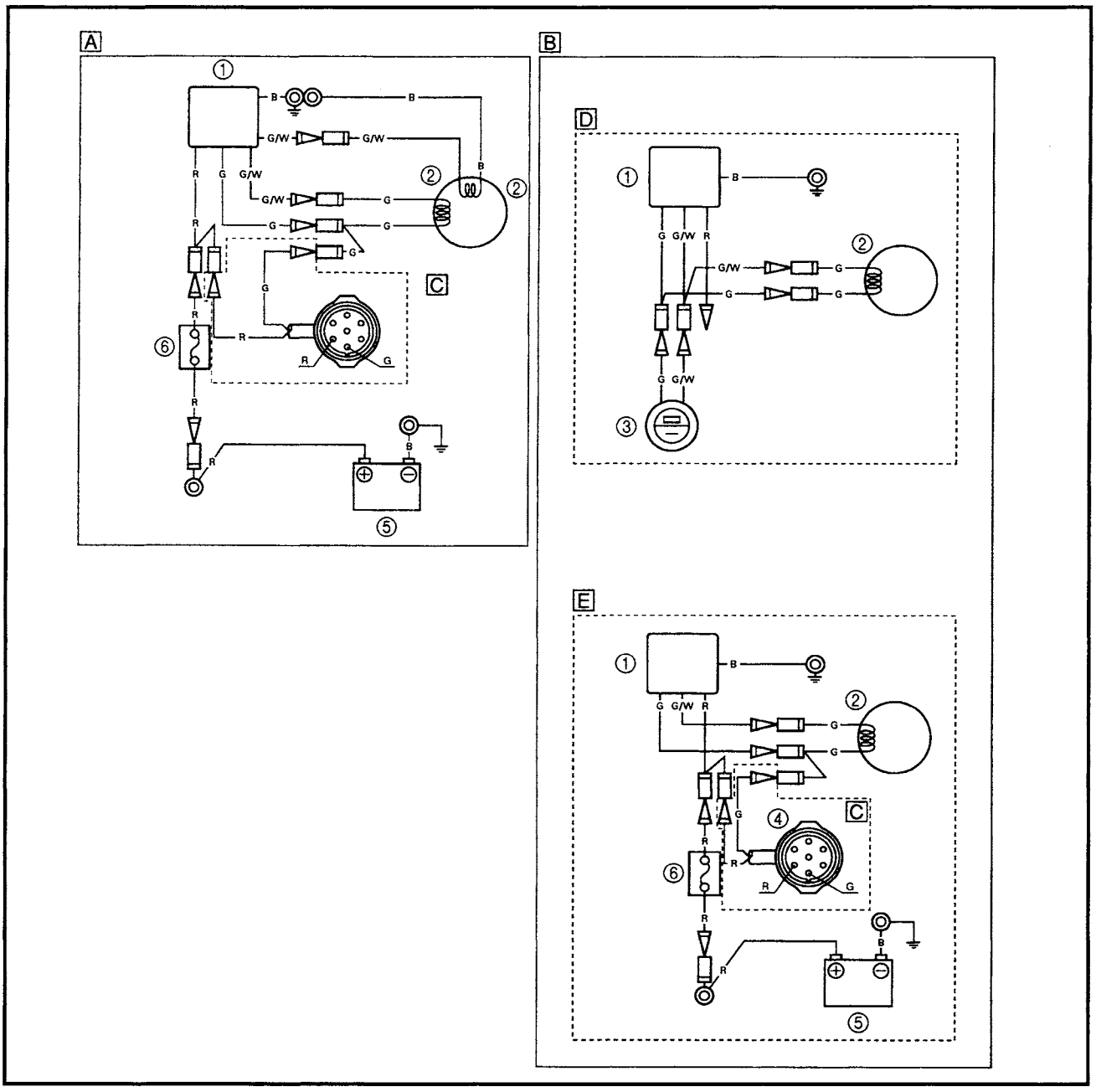
Brush holder continuity:

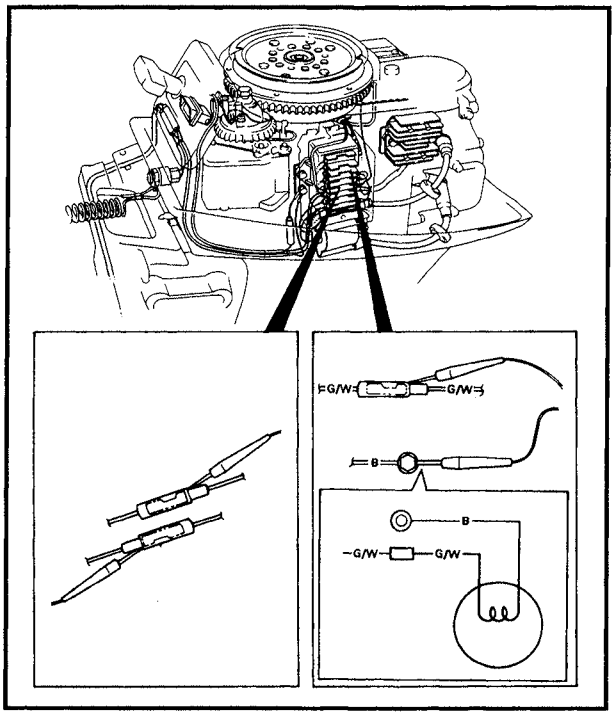
Brush holder ① - Base ②	Discontinuity

Cover inspection

1. Inspect:
   - Cover bushing
     Wear/Damage → Replace the cover.

CHARGING SYSTEM
WIRING DIAGRAM


A
B
C
D
E
B
G/W
R
G
G/W
G
G/W
G
G/W
G
G/W
R
G
G/W
G
G
G/W
R
G
G
R
G
R
G
R



CHARGING SYSTEM PEAK VOLTAGE

1. Measure:
   - Lighting coil output
     Beyond specification → Rectifier regulator/rectifier measurement.
     Below specification → Replace lighting coil.

T9.9/FT9.9A

Lighting coil output peak voltage: (minimum) (G – G)

r/min	Cranking		1,500	3,500
	Open	Connect		
V	9.0	9.0	35	75

Lighting coil output peak voltage: (minimum) (G/W – B)

r/min	Cranking		1,500	3,500
	Open	Connect		
V	8.0	8.0	30	65

F8B, F9.9/F9.9B

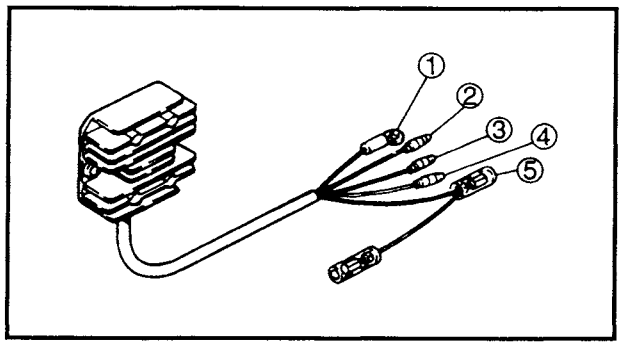
Lighting coil output peak voltage: (minimum) (G – G)

r/min	Cranking		1,500	3,500
	Open	Connect		
V	7.5	7.5	30	60

Measurement steps:
- Connect the tester to the lighting coil as shown.
- Set the tester dial to specification.

Range:
⎓ V

- Crank or start the engine.



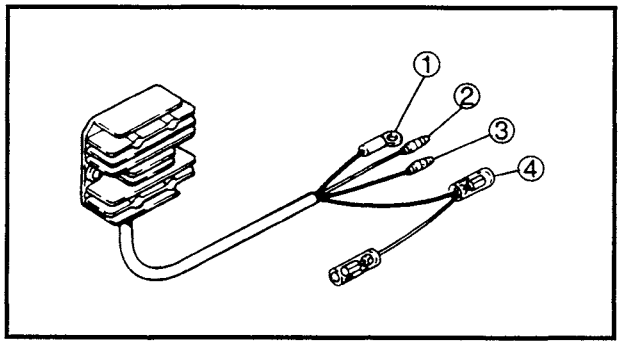
RECTIFIER REGULATORS (T9.9/FT9.9A)

1. Measure:
   - Voltage drop
     Out of specification → Replace.

Measurement steps:
- Select the function switch of digital tester to Diode inspection mode.
- Measure the voltage drop.

Tester ⊕ / Tester ⊖	① Black	② Green/White	③ Green	④ White/Green	⑤ Red
① Black		0.50 ~ 0.70	*	0.75 ~ 1.05	*
② Green/White	0.30 ~ 0.50		*	0.30 ~ 0.50	*
③ Green	0.30 ~ 0.50	0.75 ~ 1.05		0.95 ~ 1.25	*
④ White/Green	*	*	*		*
⑤ Red	0.65 ~ 0.85	0.30 ~ 0.50	0.30 ~ 0.50	0.65 ~ 0.85	

* Measured value is not affected by tester leads connection.



RECTIFIER REGULATORS (F8B, F9.9/F9.9B)

1. Check:
   - Continuity
     Out of specification → Replace.

NOTE:
The digital tester cannot be used for this inspection.

Tester ⊕ / Tester ⊖	① Green	② Green/White	③ Red	④ Black
① Green		∞	○	∞
② Green/White	∞		○	∞
③ Red	∞	∞		∞
④ Black	○	○	○	

○: Continuity.
∞: Discontinuity.

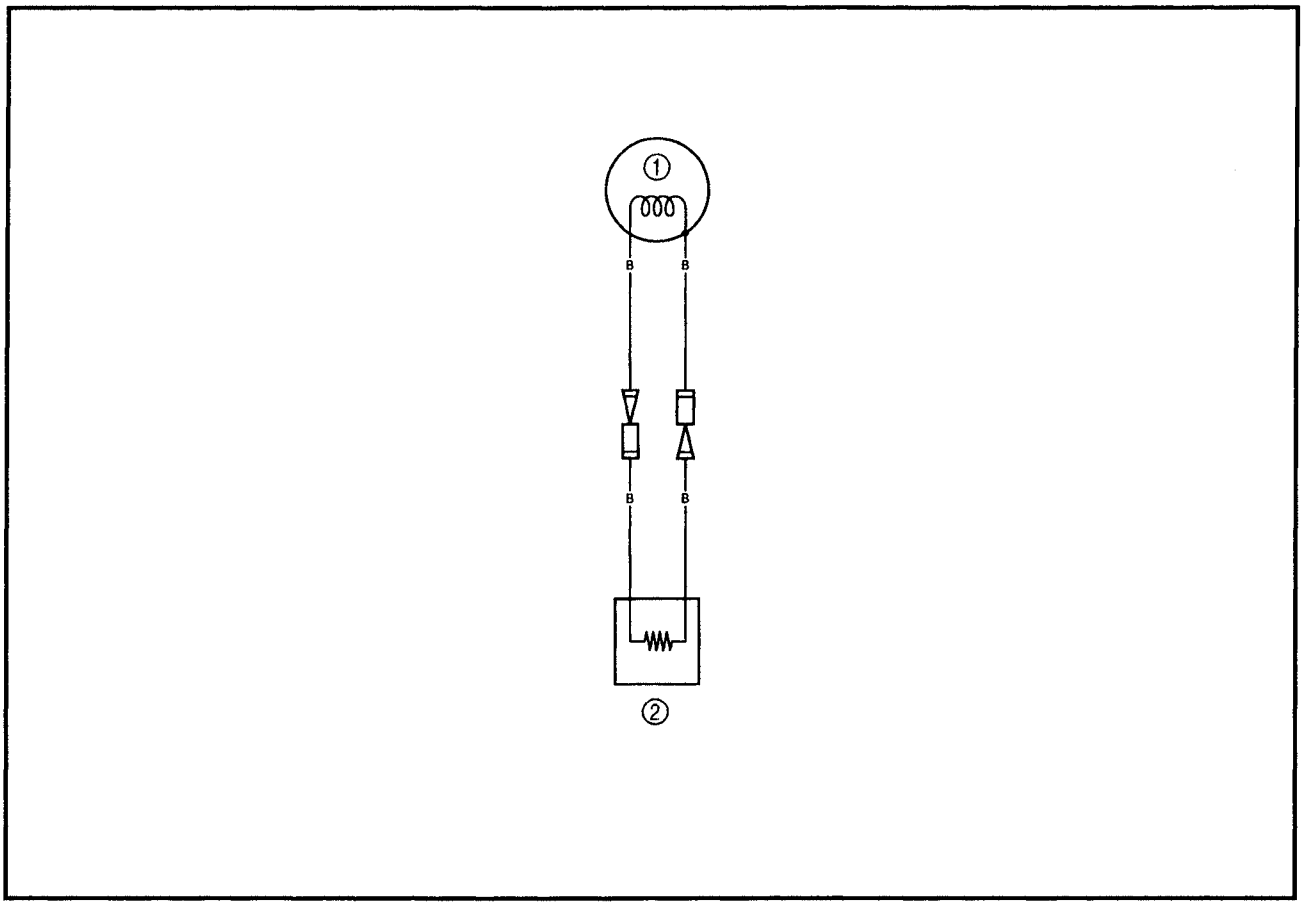
FUSE

Refer to "STARTING SYSTEM".

BATTERY

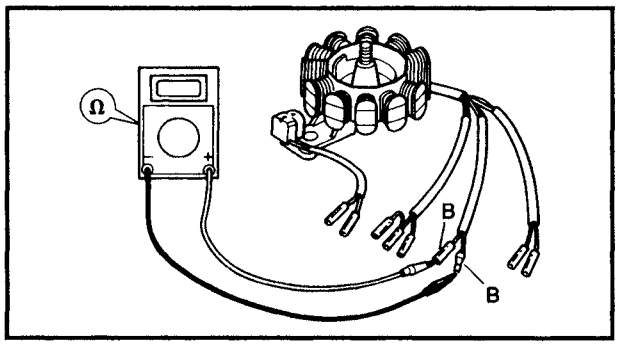
Refer to "PERIODIC SERVICE" in chapter 3.

ENRICHMENT CONTROL SYSTEM



① Valve heater coil
② Electrothermal valve

B : Black



VALVE HEATER COIL

1. Measure:
   - Valve heater coil resistance
     Out of specification → Replace.

Valve heater coil resistance:
Black (B) - Black (B)
0.24 ~ 0.36 Ω at 20°C (68°F)

NOTE:
When measuring the resistance of 10 Ω or less using the digital tester, the correct measurement cannot be obtained. Refer to "Lower resistance measurement".

ELECTROTHERMAL VALVE

Refer to "CARBURETOR" in chapter 4.

CHAPTER 9
TROUBLE ANALYSIS

TROUBLE ANALYSIS 9-1
TROUBLE ANALYSIS CHART 9-1

TROUBLE ANALYSIS

NOTE:

The following items should be checked before the "Trouble analysis" chart is consulted.
1. The battery is charged and its specific gravity is within specification.
2. There are no incorrect wiring connections.
3. Wiring connections are properly secured and are not rusty.
4. The lanyard is attached to the engine stop switch.
5. The shift position is neutral.
6. Fuel is reaching the carburetor.
7. The rigging and engine settings are correct.
8. Engine is free from any "Hull problem".

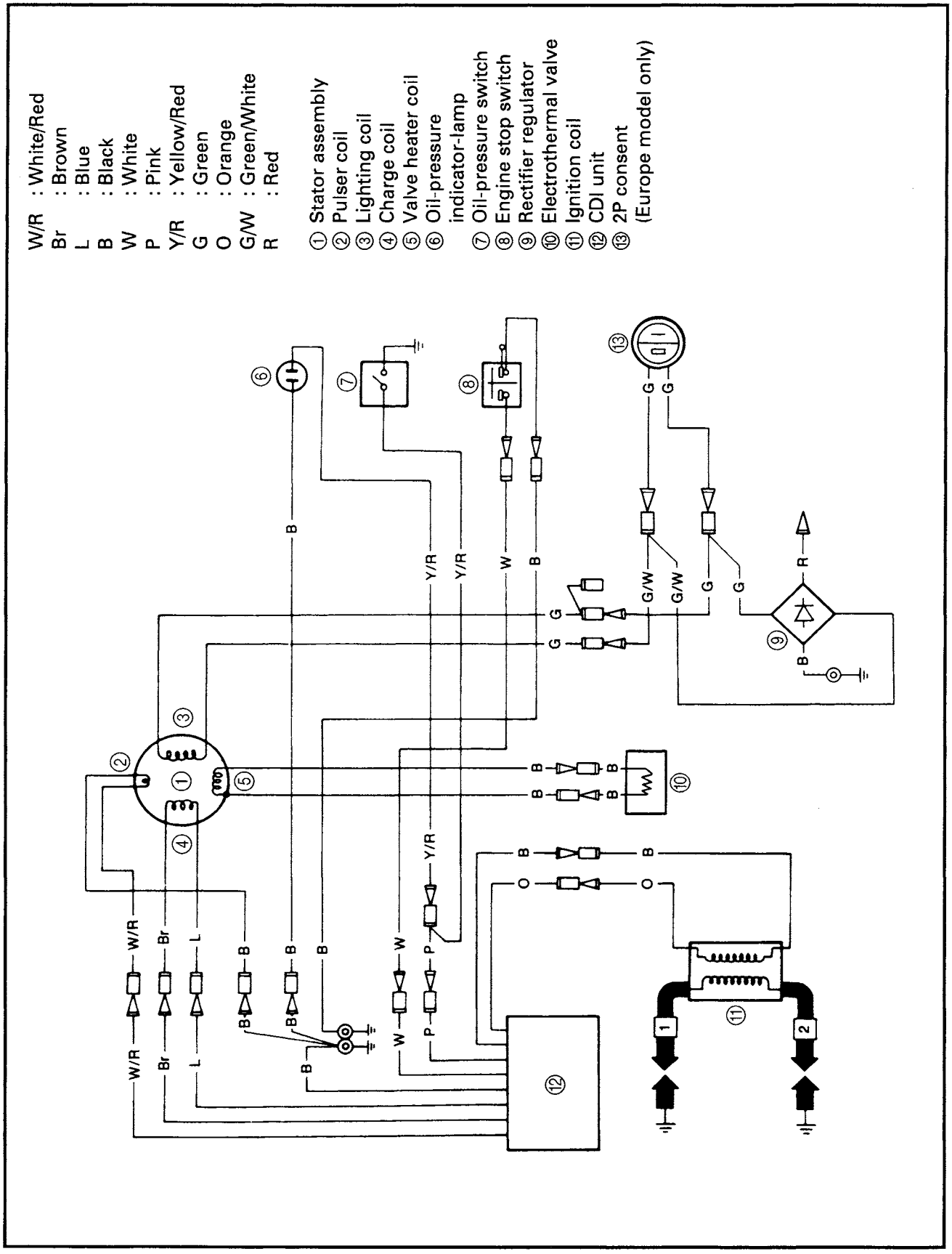
TROUBLE ANALYSIS CHART

Problem												Check	
ENGINE WILL NOT START	ROUGH IDLING	ENGINE STALLS	POOR DECELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	OVERHEATING	LOOSE STEERING	LOOSE TILT HOLDING	SHIFTING DIFFICULT	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Related part	Reference chapter
												FUEL SYSTEM	
○		○			○							Fuel hose	4
○					○							Fuel joint	4
○	○				○							Fuel filter	4
○					○							Fuel pump	4
○	○				○							Carburetor	4
	○	○										● Idle speed	3
	○	○				○						● Pilot screw	3
												POWER UNIT	
○	○	○		○		○						Spark plug	3
○	○				○							Compression	3
○												Timing belt	3
○												Tappet clearance	3
○	○				○							IN, EX. valve	3
○	○				○							IN, EX. valve seat	3
○												Cylinder head gasket	5
○					○							Piston ring	5
○					○							Piston	5
						○						Thermostat	5
						○						Water passage	5

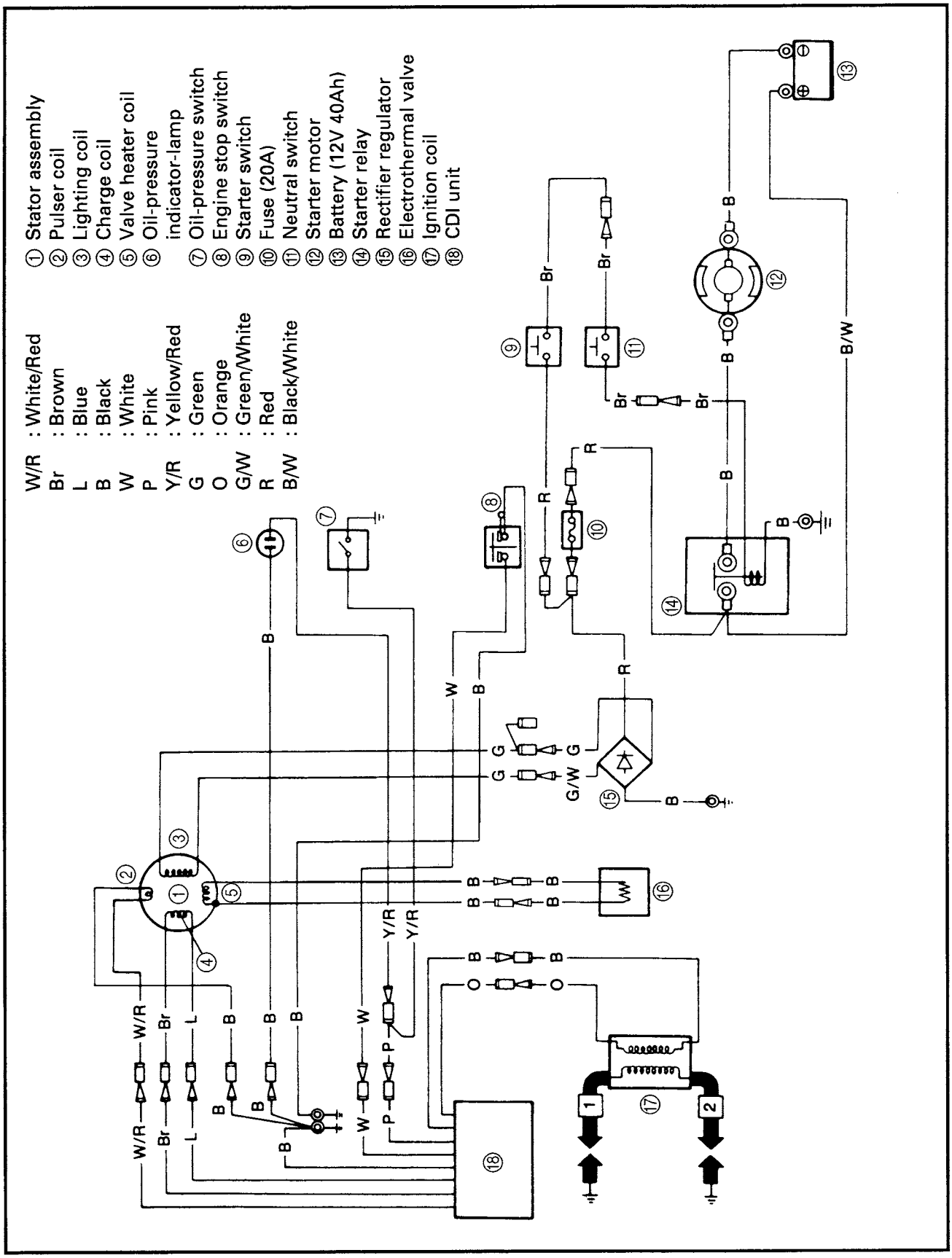
TROUBLE ANALYSIS

Problem												Check	
ENGINE WILL NOT START	ROUGH IDLING	ENGINE STALLS	POOR DECELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	OVERHEATING	LOOSE STEERING	LOOSE TILT HOLDING	SHIFTING DIFFICULT	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Related part	Reference chapter
												LOWER UNIT	
○									○			Neutral position	6
○									○			Clutch	6
○									○			Gear	6
					○	○						Water inlet	6
					○	○						Water pump	6
					○							Propeller shaft	6
									○			Shifter/Pin	6
									○			Shift cam	6
									○			Shift shaft	6
									○			Lower case	6
												BRACKET UNIT	
							○					Bracket	7
							○					Mount rubber	7
												ELECTRICAL	
○	○	○			○							Ignition system	8
○				○								Starting system	8
	○	○			○							Enrichment control system	8
					○					○		Ignition control system	8

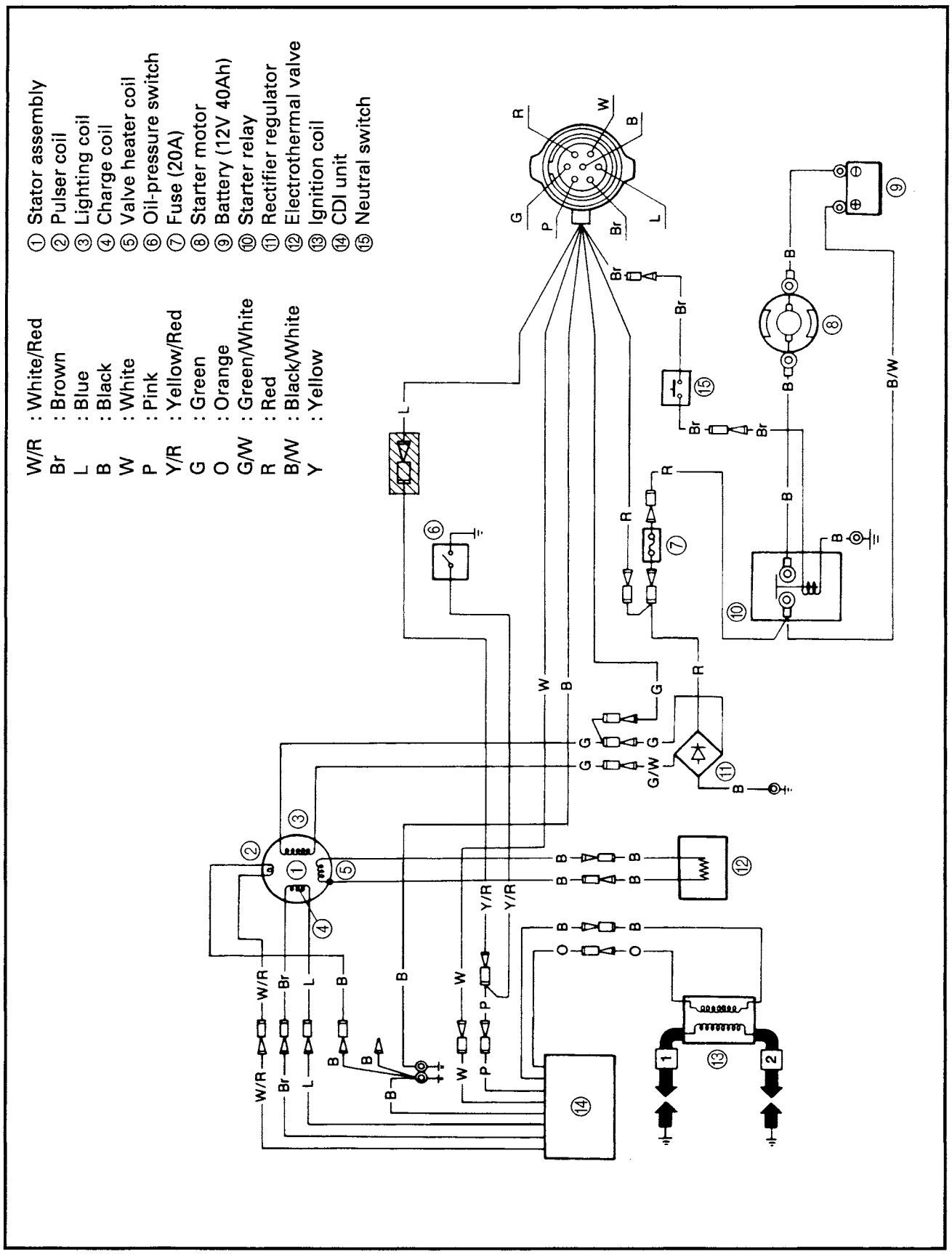
WIRING DIAGRAM
F8BMH, F9.9MH/F9.9BMH



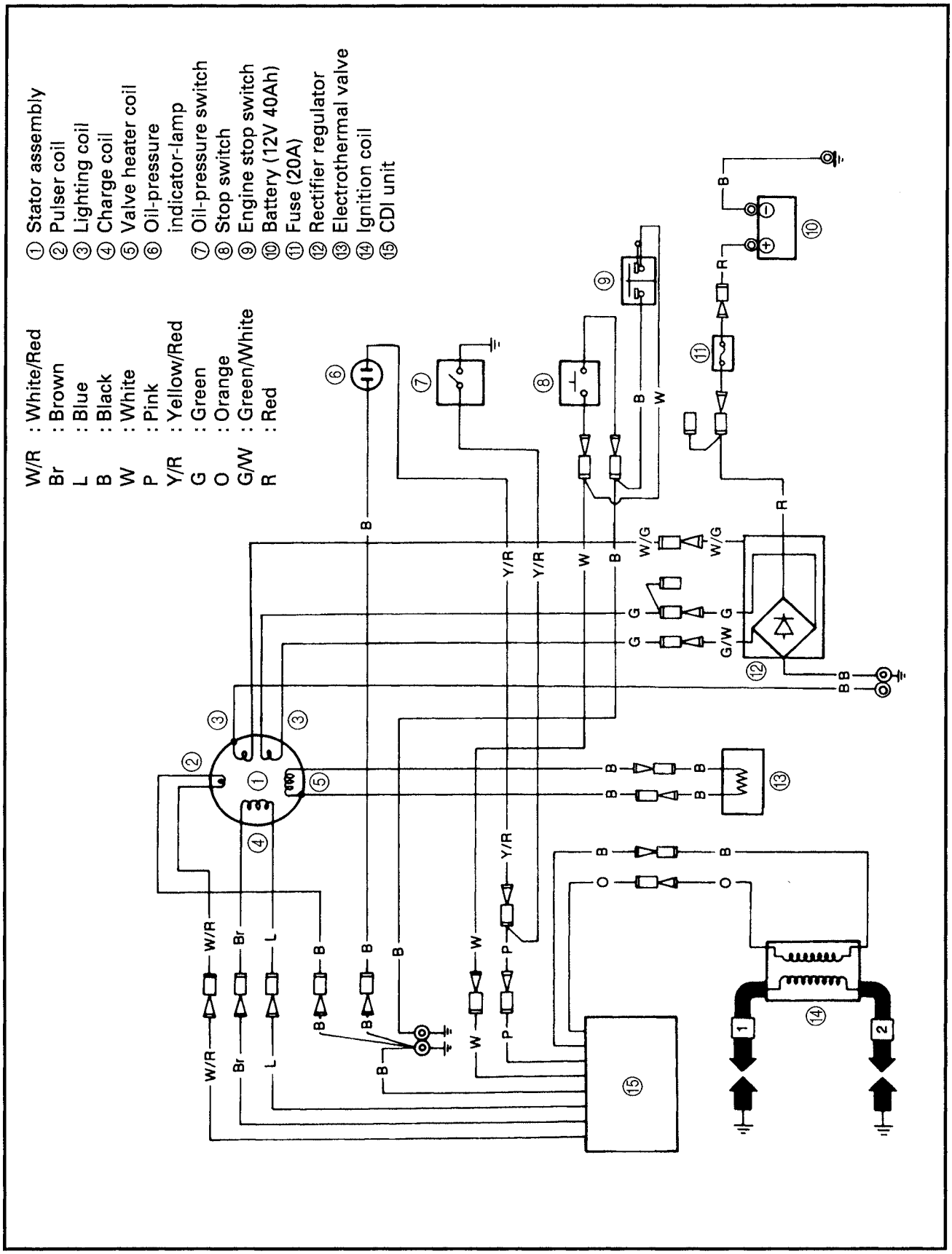
F8BEH, F9.9EH/F9.9BEH



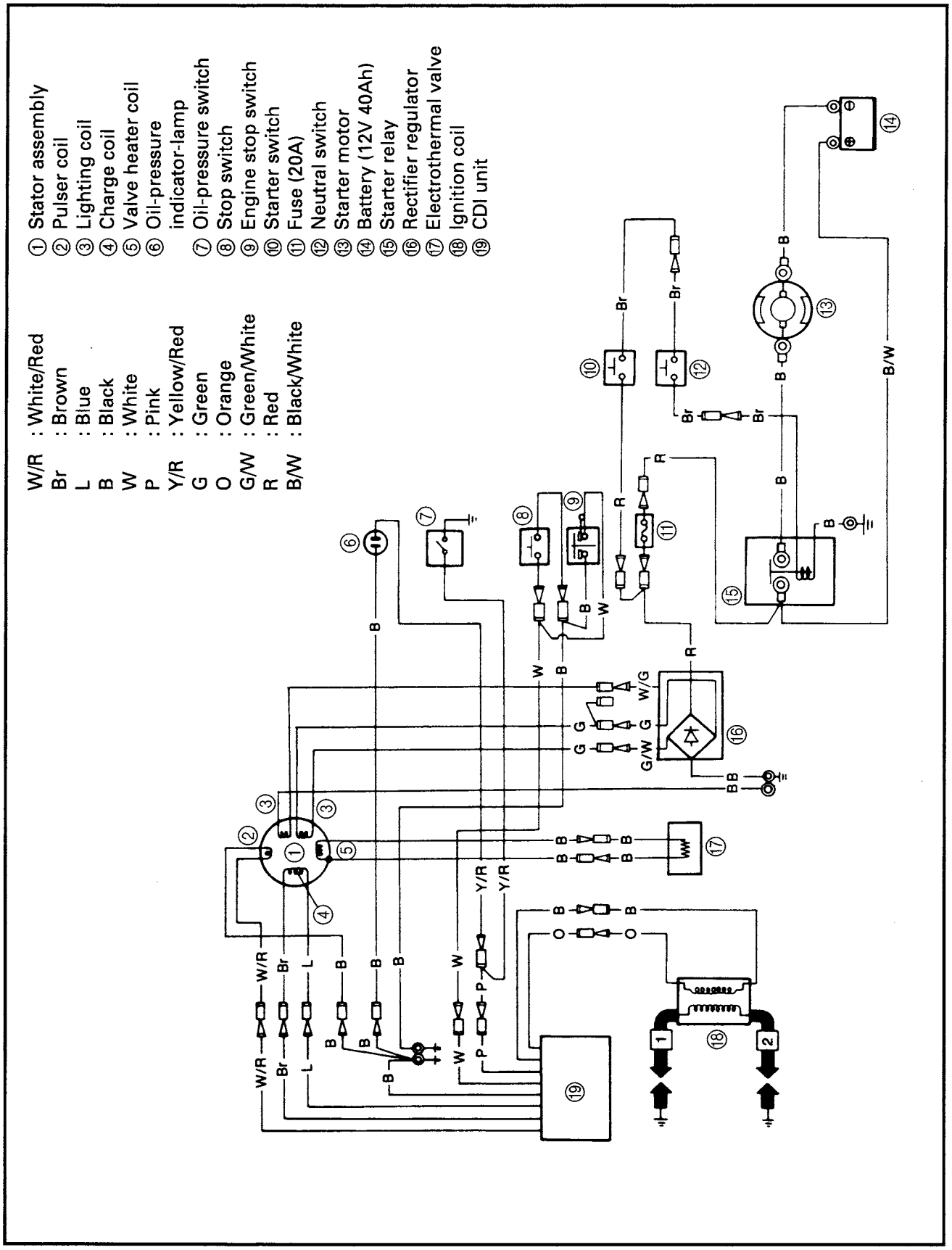
F8BE, F9.9BE


W/R : White/Red
Br : Brown
L : Blue
B : Black
W : White
P : Pink
Y/R : Yellow/Red
G : Green
O : Orange
G/W : Green/White
R : Red
B/W : Black/White
Y : Yellow
① Stator assembly
② Pulser coil
③ Lighting coil
④ Charge coil
⑤ Valve heater coil
⑥ Oil-pressure switch
⑦ Fuse (20A)
⑧ Starter motor
⑨ Battery (12V 40Ah)
⑩ Starter relay
⑪ Rectifier regulator
⑫ Electrothermal valve
⑬ Ignition coil
⑭ CDI unit
⑮ Neutral switch

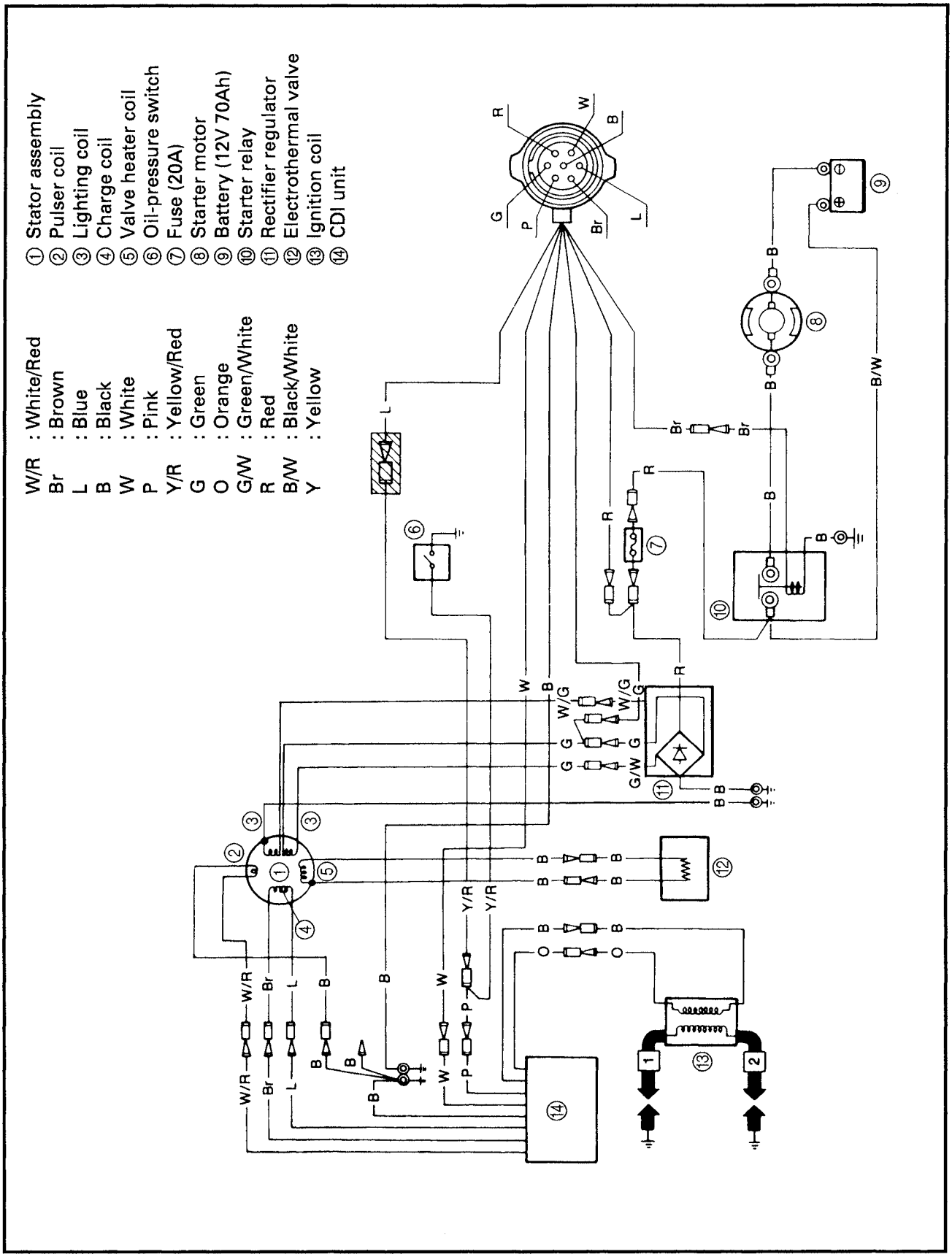
T9.9MH/FT9.9AMH



T9.9EH/FT9.9AEH



T9.9ER/FT9.9AE



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